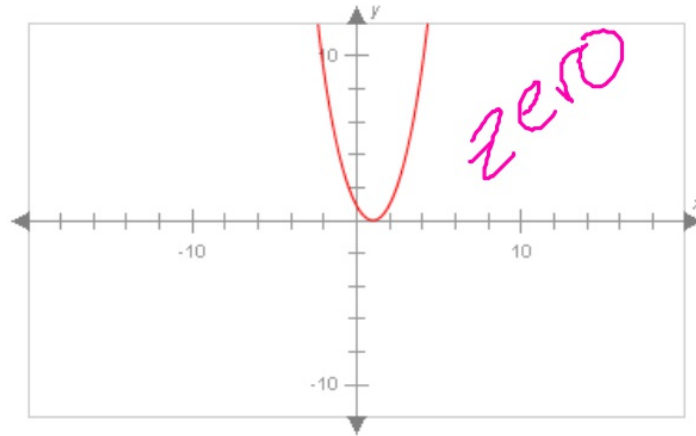
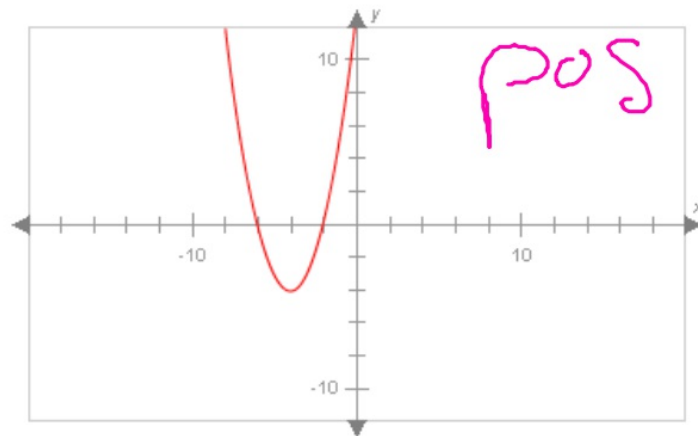
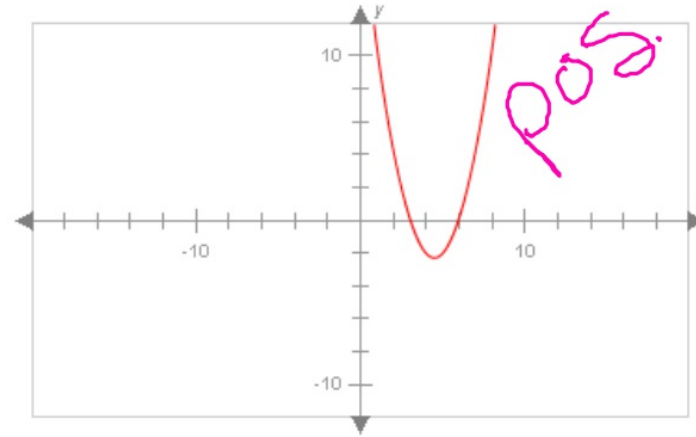
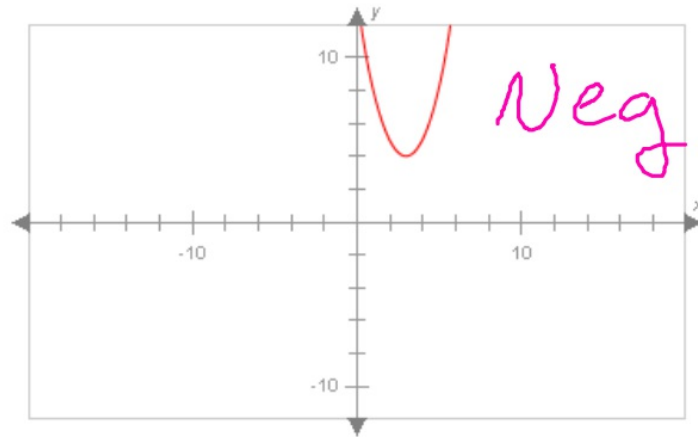


## Algebra Advanced s1 Unit 4:

2/24/14

### Undoing Functions and Moving Them Around

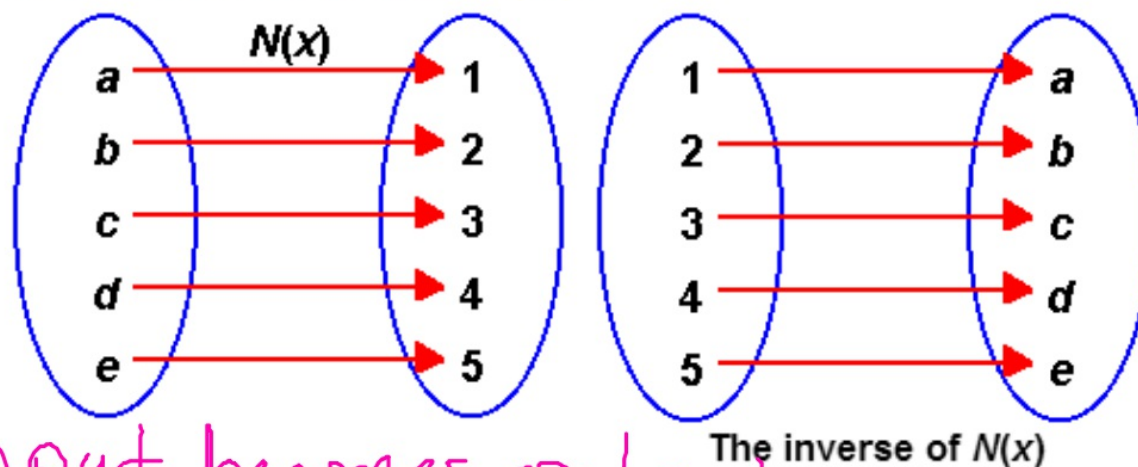
Identify the sign of the discriminant  
given the graph of a quadratic.



## 4.1 Inverses

2/24/14

Determine the ordered pair that represents the inverse of the function  $F(x)$ , given an ordered pair of the function  $F(x)$ .



input becomes output

Original

Inverse

(4, 3)

(3, 4)

(12, 1)

(1, 12)

(-4, 7)

(7, -4)

(2, -5)

(-5, 2)

(8, 6)

(6, 8)

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ . I will capture my thinking using the math note catcher including teacher and student-team modeled example problems on the Promethean board. I will demonstrate my understanding on my exit ticket.

## 4.1 Inverses

Given  $F(x)$ , find  $F^{-1}(y)$ .

$$f(x) = x - 6$$

$$y = x - 6$$

$$+6 \quad +6$$

$$y + 6 = x$$

$$x = y + 6$$

$$f^{-1}(y) = y + 6$$

2/24/14

$$\begin{aligned} f^{-1} \\ f^{-1}(f(x)) &= x \\ f(f^{-1}(x)) &= x \end{aligned}$$

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ .



## 4.1 Inverses

2/24/14

Given  $F(x)$ , find  $F^{-1}(y)$ .

$$f(x) = 3x + 8$$

$$y = 3x + 8$$
$$\begin{array}{r} -8 \\ -8 \end{array}$$

$$\frac{y-8}{3} = \frac{3x}{3}$$

$$x = \frac{y-8}{3}$$

$$f^{-1}(y) = \frac{y-8}{3}$$

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ .

## 4.1 Inverses

2/24/14

Given  $F(x)$ , find  $F^{-1}(y)$ .

$$f(x) = \frac{x}{4} + 3$$

$$y = \frac{x}{4} + 3$$

$$4 \cdot y - 3 = \frac{x}{4} \cdot 4$$

$$x = 4(y - 3)$$

$$x = 4y - 12$$

$$f^{-1}(y) = 4y - 12$$

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ .

## 4.1 Inverses

2/24/14

Given the original function, find the inverse.

$$p(t) = 3t^2 - 7$$

$$y = 3t^2 - 7$$

$$\frac{y+7}{3} = \frac{3t^2}{3}$$

$$\sqrt{\frac{y+7}{3}} = \sqrt{t^2}$$

$$t = \pm \sqrt{\frac{y+7}{3}}$$

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ .

## 4.1 Inverses

2/24/14

Given the original function, find the inverse.

$$p(t) = \sqrt{3t + 4}$$
$$y^2 = \sqrt{3t + 4}^2$$

$$y^2 = 3t + 4$$
$$\begin{array}{r} -4 \\ -4 \end{array}$$

$$\frac{y^2 - 4}{3} = \frac{3t}{3}$$

$$t = \frac{y^2 - 4}{3}$$

$$f^{-1}(y) = \frac{y^2 - 4}{3}$$

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ .

Vocabulary 4.1.1 p. 23  
Practice problems 4.1.2

Complete quizzes 4.1.3 & 4.1.4

IWBAT compare the domain and range of a given function to the domain and range of its inverse function, identify the equation for the inverse of  $F(x)$ , and identify the equation for the inverse of a function, given an original function with variables other than  $x$  and  $y$ .



## 4.2 Graphs of Inverses

2/25/14

Find the inverse for these functions.

$$f(x) = \frac{2x+3}{6}$$

$$6 \cdot y = \frac{2x+3}{6} \cdot 6$$

$$6y = 2x+3$$

$$\frac{6y-3}{2} = \frac{2x}{2}$$

$$x = \frac{6y-3}{2}$$

$$f^{-1}(y) = \frac{6y-3}{2}$$

$$f(x) = \frac{2}{3}x + 5$$

$$y - 5 = \frac{2}{3}x$$

$$\frac{3(y-5)}{2} = \frac{2x}{2}$$

$$x = \frac{3(y-5)}{2}$$

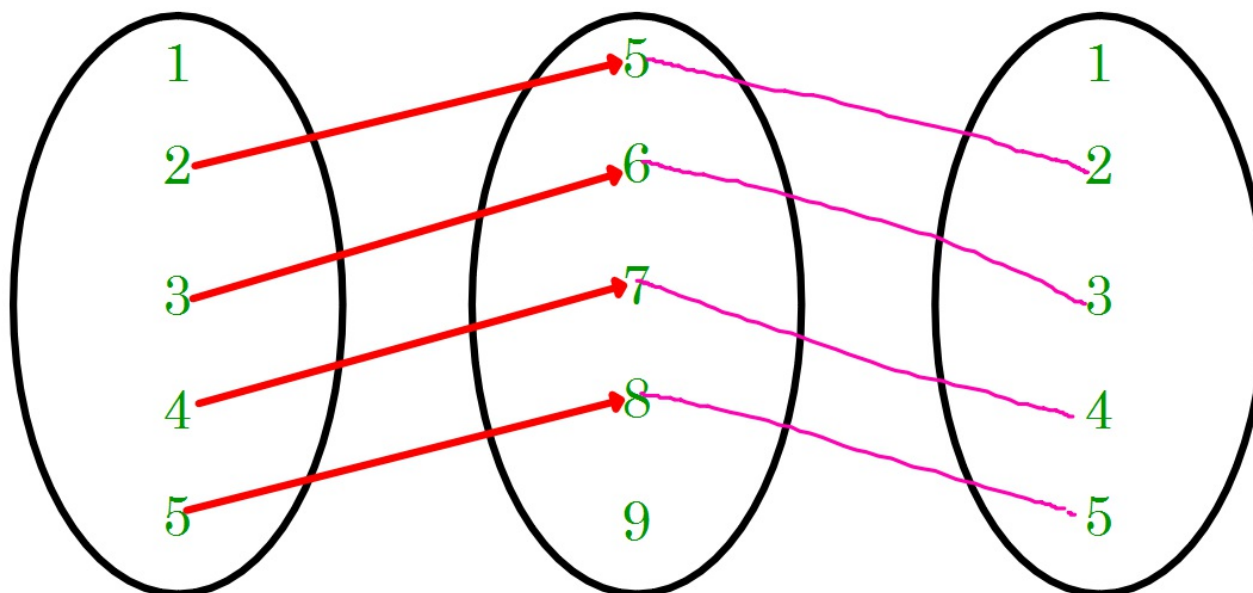
$$f^{-1}(y) = \frac{3(y-5)}{2}$$

## 4.2 Graphs of Inverses

2/25/14

Use a mapping diagram to determine whether the inverse of a given function is also a function.

Is this a function?



Is the inverse a function?

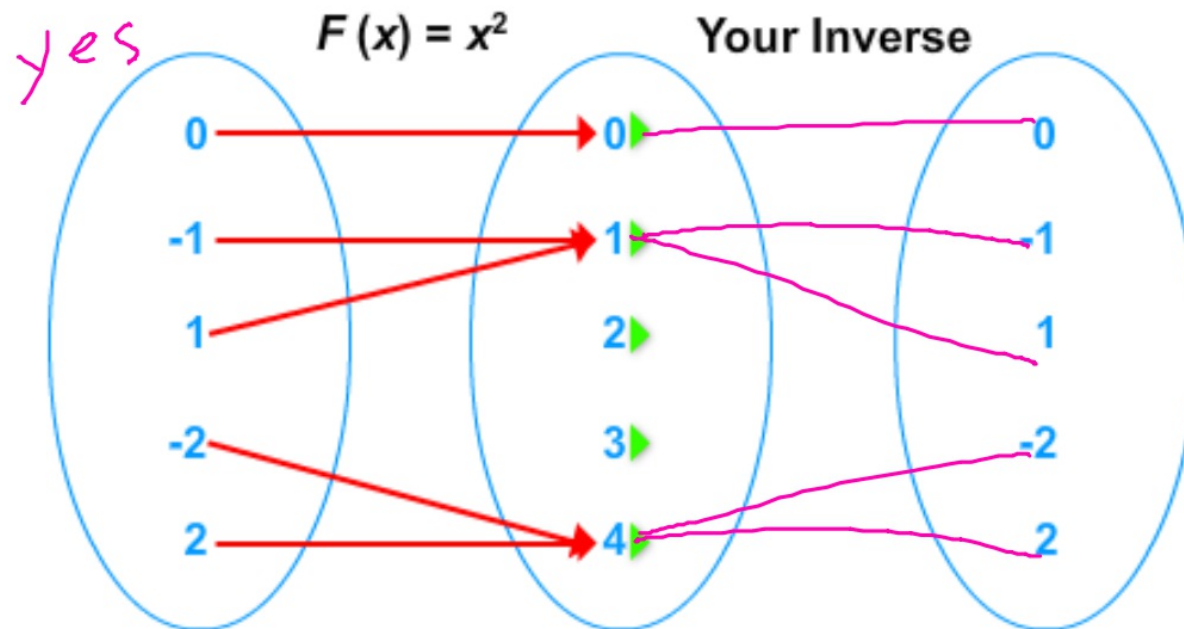
$$y = x + 3$$

yes

## 4.2 Graphs of Inverses

2/25/14

Use a mapping diagram to determine whether the inverse of a given function is also a function.



Is the inverse a function?

NO

## 4.2 Graphs of Inverses

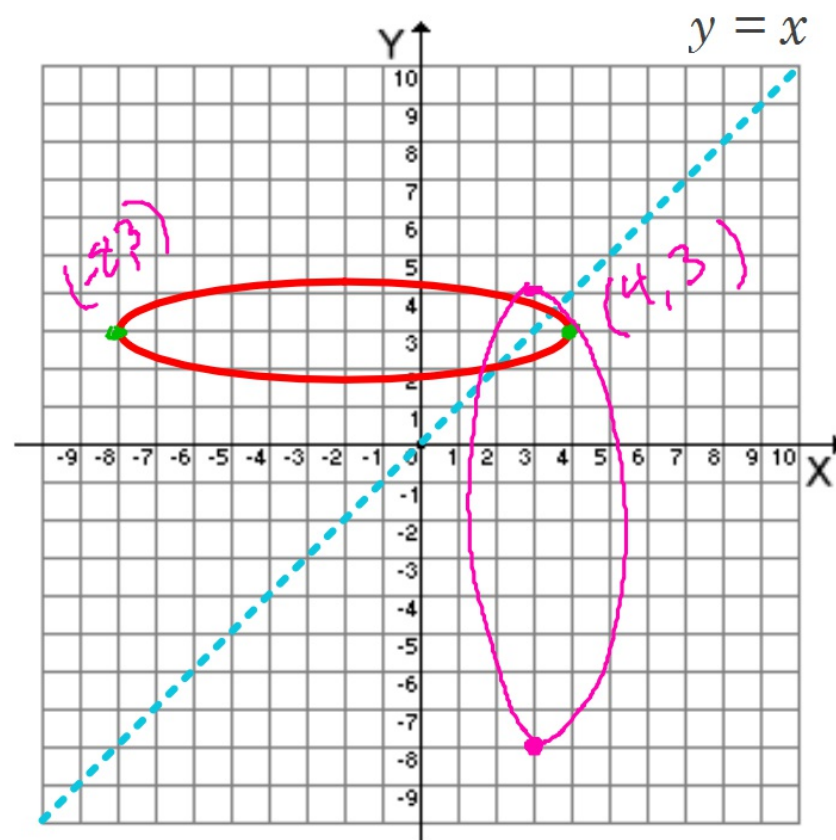
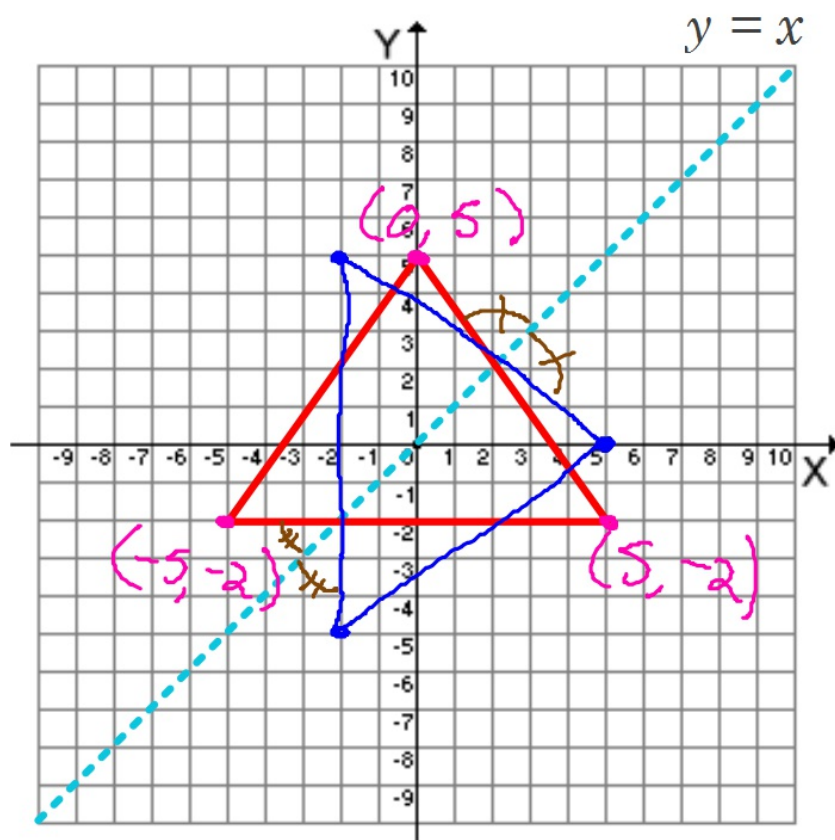
2/25/14

IWBAT identify the graph of the inverse of a function, given the graph of the original function; identify the result of flipping a graph over the line  $y = x$ ; and apply the horizontal line test to determine whether the inverse of a given function is also a function. I will capture my thinking using the math note catcher including teacher and student-team modeled example problems on the Promethean board. I will demonstrate my understanding on my exit ticket.



## 4.2 Graphs of Inverses

2/25/14



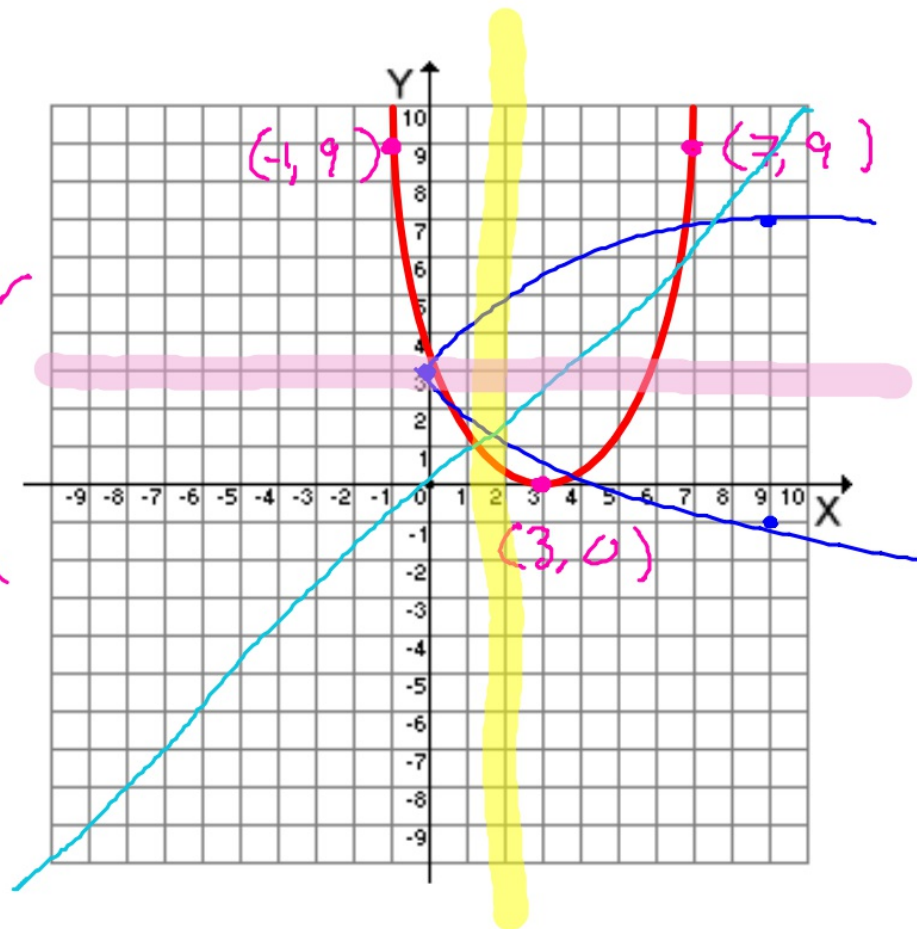
IWBAT identify the graph of the inverse of a function, given the graph of the original function; identify the result of flipping a graph over the line  $y = x$ ; and apply the horizontal line test to determine whether the inverse of a given function is also a function.



## 4.2 Graphs of Inverses

2/25/14

horizontal  
line test  
tells whether  
the inverse  
is or is not  
a function

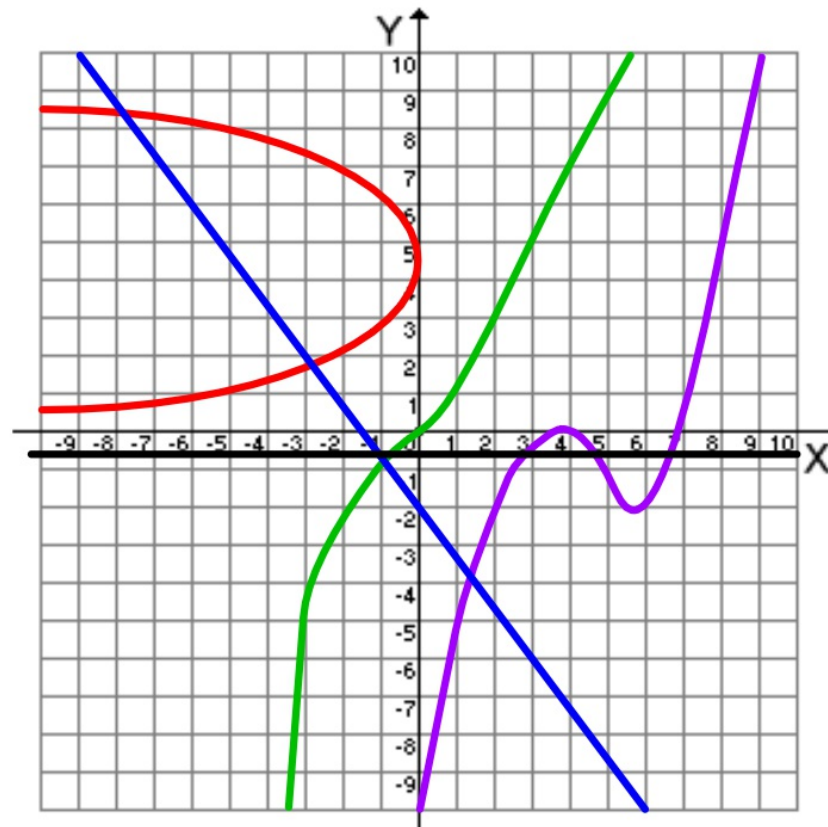


IWBAT identify the graph of the inverse of a function, given the graph of the original function; identify the result of flipping a graph over the line  $y = x$ ; and apply the horizontal line test to determine whether the inverse of a given function is also a function.

## 4.2 Graphs of Inverses

2/25/14

The inverse of which of these will be a function?



	original		inverse
A	✓	✓	✓
B	✓	✓	✓
C	✓	✓	X
D	X	X	✓

*Pract*

### Horizontal line test

IWBAT identify the graph of the inverse of a function, given the graph of the original function; identify the result of flipping a graph over the line  $y = x$ ; and apply the horizontal line test to determine whether the inverse of a given function is also a function.

## 4.2 Graphs of Inverses

2/25/14

Vocabulary 4.2.1 p. 16  
Practice problems 4.2.2

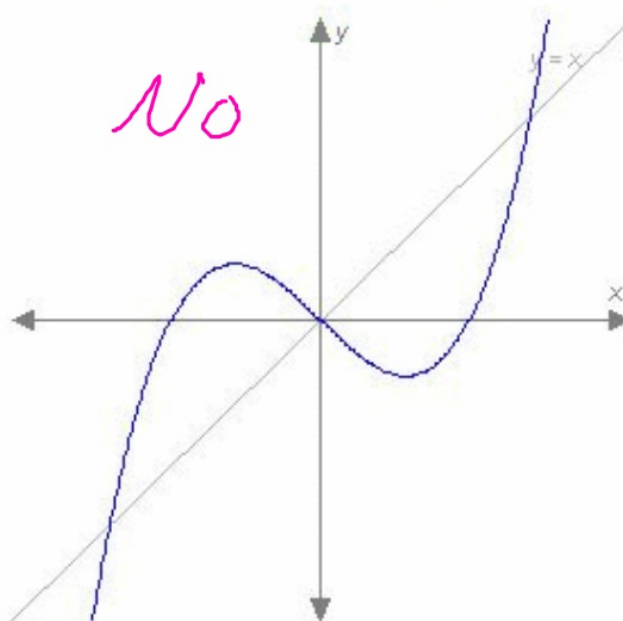
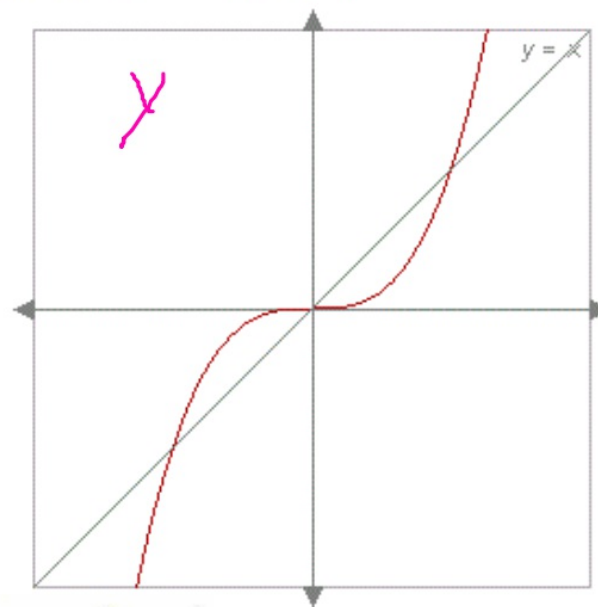
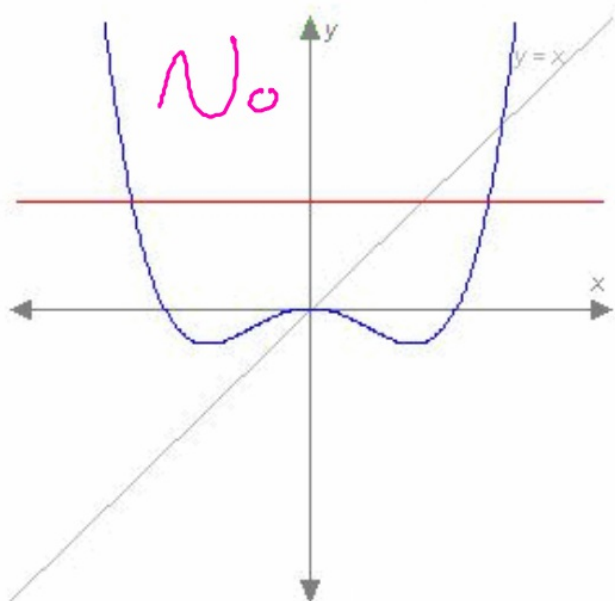
Complete quiz 4.2.3

IWBAT identify the graph of the inverse of a function, given the graph of the original function; identify the result of flipping a graph over the line  $y = x$ ; and apply the horizontal line test to determine whether the inverse of a given function is also a function.

## 4.3 Parent Functions

2/26/14

Apply the horizontal line test to determine whether the inverse of a given function is also a function.



## 4.3 Parent Functions

2/26/14

**Define parent function and describe the key properties of the quadratic parent function and visually identify its graph.**

Parent function - Simplest form of a function



## 4.3 Parent Functions

2/26/14

Define parent function and describe the key properties of the quadratic parent function and visually identify its graph.

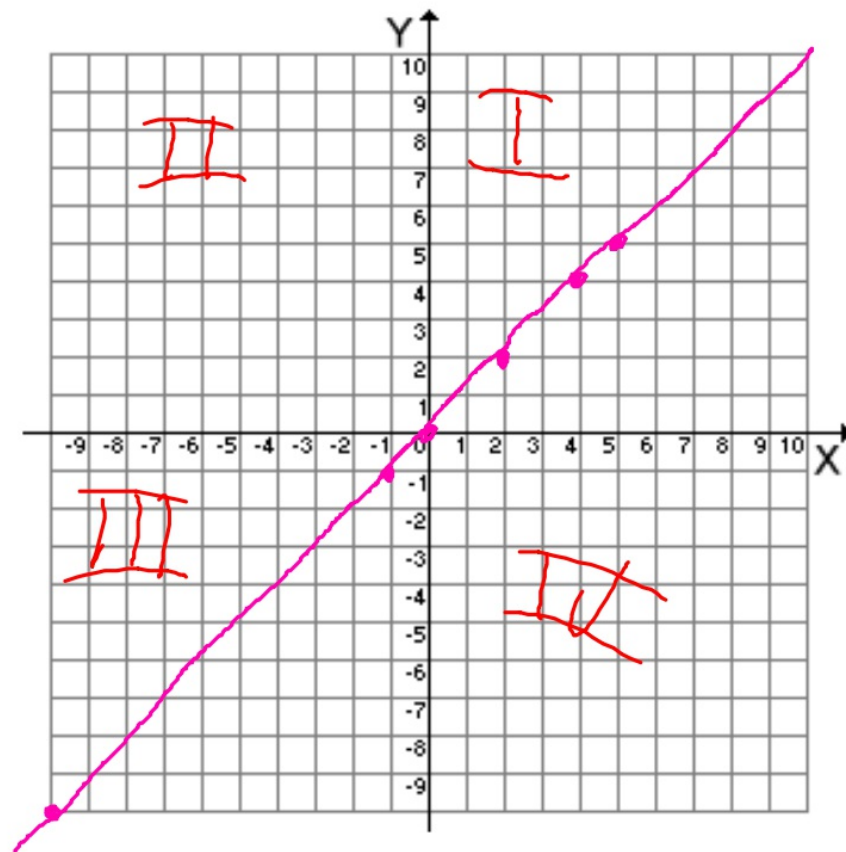
$y = x$  Linear parent function

1) Goes through the origin

2) Quadrants I + III

3) Slope = +1

x	y
5	5
2	2
4	4
-1	-1
-10	-10
0	0



## 4.3 Parent Functions

2/26/14

Define parent function and describe the key properties of the quadratic parent function and visually identify its graph.

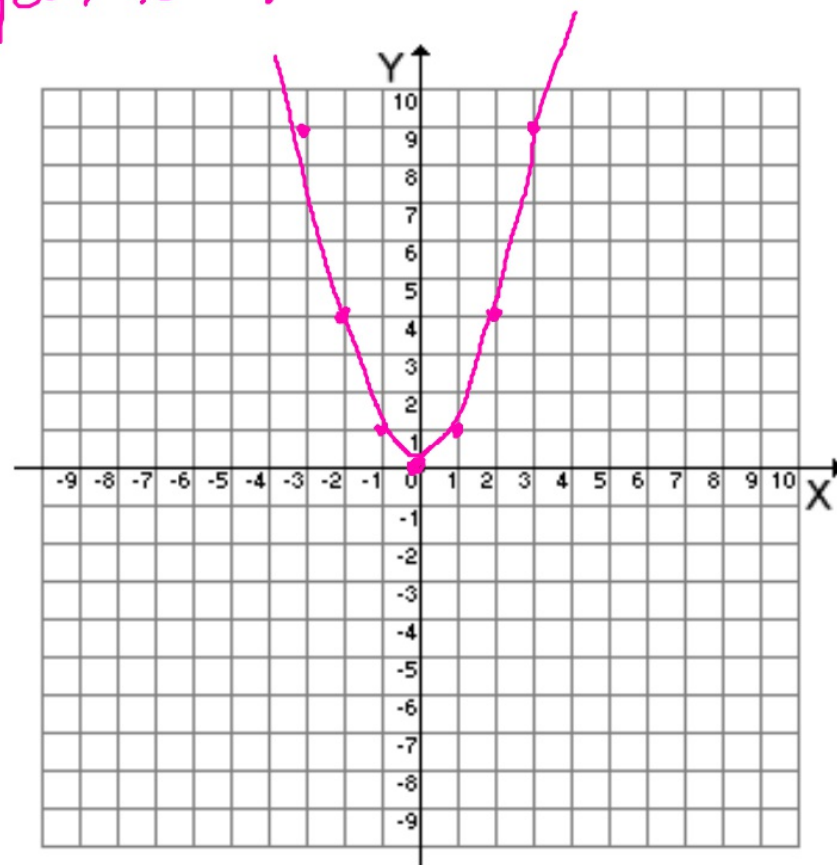
$$y = x^2 \text{ quadratic parent function}$$

1) Goes through the origin (0,0)

2) parabola

3) Quadrants I+II

x	y
1	1
3	9
-4	16
-2	4
0	0



IWBAT describe the key properties of the reciprocal parent function and visually identify its graph, describe the key properties of the linear parent function and visually identify its graph, and describe the key properties of the absolute value parent function and visually identify its graph. I will capture my thinking using the math note catcher including teacher and student-team modeled example problems on the Promethean board. I will demonstrate my understanding on my exit ticket.

## 4.3 Parent Functions

Reciprocal

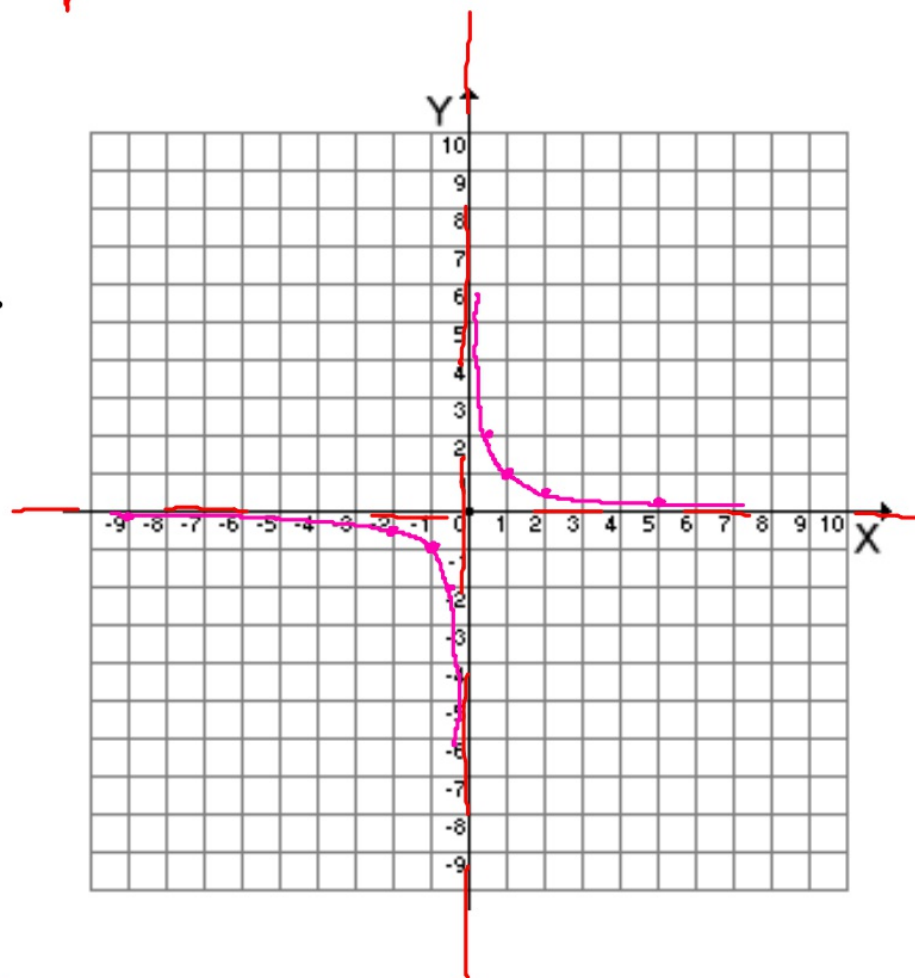
$$y = \frac{1}{x}$$

a symptote

2/26/14

- 1) Hyperbola
- 2) Does Not go through the origin
- 3) Quadrants I + III

x	y
1	1
2	$\frac{1}{2}$
5	$\frac{1}{5}$
-9	$-\frac{1}{9}$
-1	-1
-2	$-\frac{1}{2}$
$\frac{1}{2}$	2
$-\frac{1}{2}$	-2



IWBAT describe the key properties of the reciprocal parent function and visually identify its graph, describe the key properties of the linear parent function and visually identify its graph, and describe the key properties of the absolute value parent function and visually identify its graph.



## 4.3 Parent Functions

2/26/14

Absolute Value

$$y = |x|$$

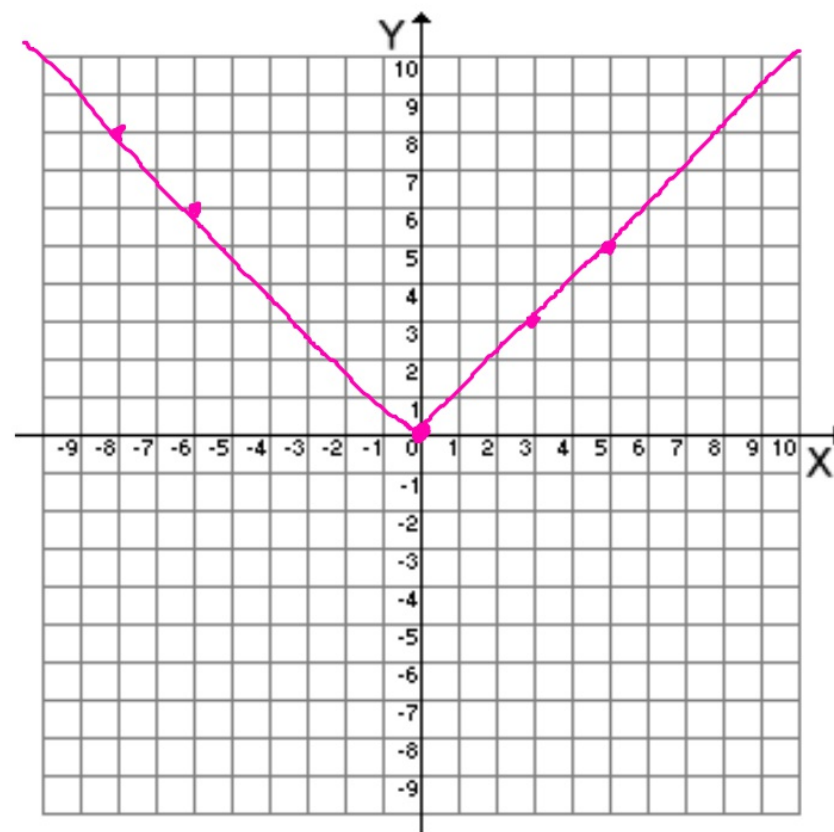
1) Goes through the origin

2) Quadrant I + II

3) U-shaped

4)  $x > 0$ , slope = +1  
 $x < 0$ , slope = -1

$x$	$y$
5	5
3	3
-8	8
-6	6
0	0

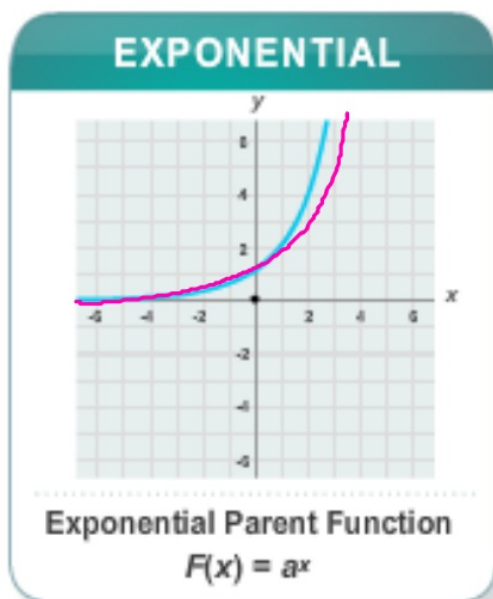


IWBAT describe the key properties of the reciprocal parent function and visually identify its graph, describe the key properties of the linear parent function and visually identify its graph, and describe the key properties of the absolute value parent function and visually identify its graph.

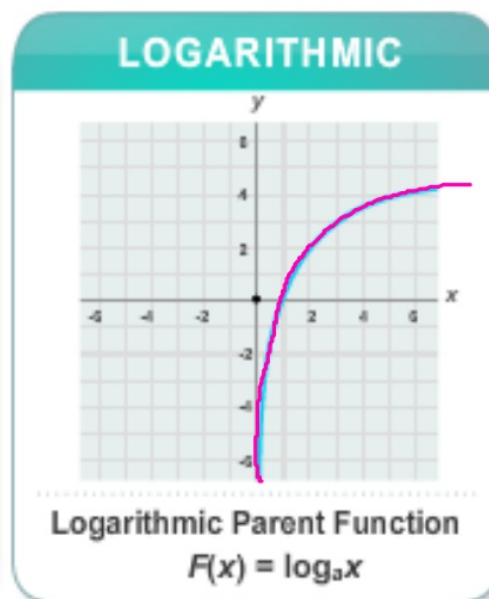


## 4.3 Parent Functions

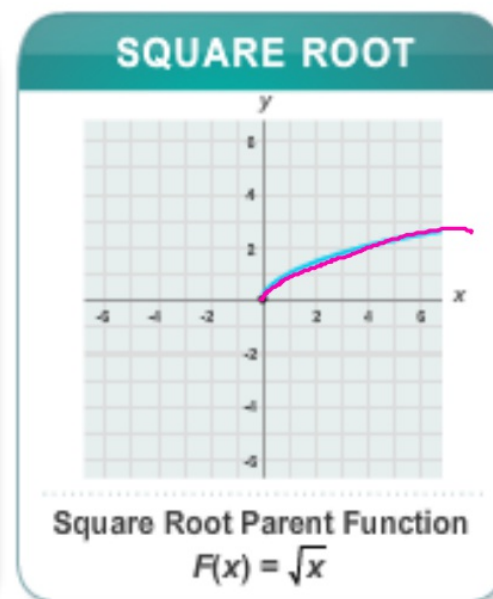
2/26/14



$$y = a^x$$



$$y = \log(x)$$

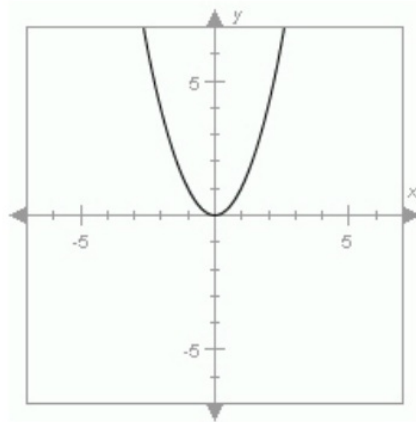


$$y = \sqrt{x}$$

IWBAT describe the key properties of the reciprocal parent function and visually identify its graph, describe the key properties of the linear parent function and visually identify its graph, and describe the key properties of the absolute value parent function and visually identify its graph.

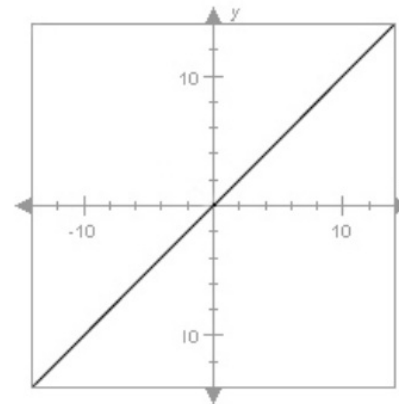
## 4.3 Parent Functions

2/26/14



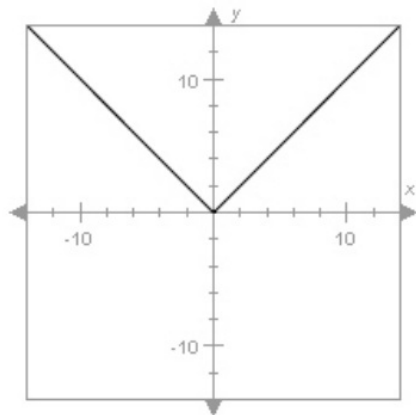
Which parent function does this graph represent?

- ☐ Linear
- ☒ Quadratic
- ☐ Absolute value
- ☐ Reciprocal



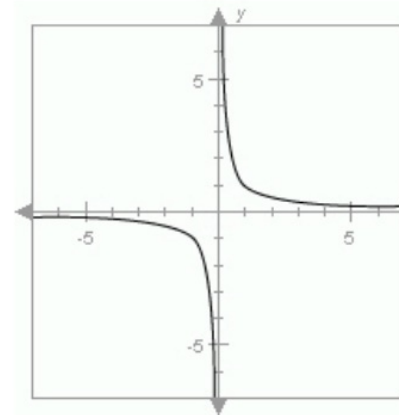
Which parent function does this graph represent?

- ☒ Linear
- ☐ Quadratic
- ☐ Absolute value
- ☐ Reciprocal



Which parent function does this graph represent?

- ☐ Linear
- ☐ Quadratic
- ☒ Absolute value
- ☐ Reciprocal



Which parent function does this graph represent?

- ☐ Linear
- ☐ Quadratic
- ☐ Absolute value
- ☒ Reciprocal

IWBAT describe the key properties of the reciprocal parent function and visually identify its graph, describe the key properties of the linear parent function and visually identify its graph, and describe the key properties of the absolute value parent function and visually identify its graph.

Vocabulary 4.3.1 p. 16  
Practice problems 4.3.2

Complete quiz 4.3.3

IWBAT describe the key properties of the reciprocal parent function and visually identify its graph, describe the key properties of the linear parent function and visually identify its graph, and describe the key properties of the absolute value parent function and visually identify its graph.

## 4.4 Shifting Functions

2/27/14

Describe the parent functions for the linear and quadratic families.

Linear  $y = x$

Quadratic  $y = x^2$

1) Goes through Origin

2) Quadrants I + III

3) Slope = +1

1) Goes through the origin (0,0)

2) is a Parabola

3) quadrants I + II



## 4.4 Shifting Functions

2/27/14

**Describe the parent functions for reciprocal and absolute value families.**

Reciprocal  $y = \frac{1}{x}$

- 1) Hyperbola
- 2) Does not go through the origin
- 3) Quadrants I + III

Absolute Value  $y = |x|$

- 1) V-shaped
- 2) Goes through the origin
- 3) Quadrants I + II
- 4)  $x > 0$ , slope = +1  
 $x < 0$ , slope = -1



IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph. I will capture my thinking using the math note catcher including teacher and student-team modeled example problems on the Promethean board. I will demonstrate my understanding on my exit ticket.

## 4.4 Shifting Functions

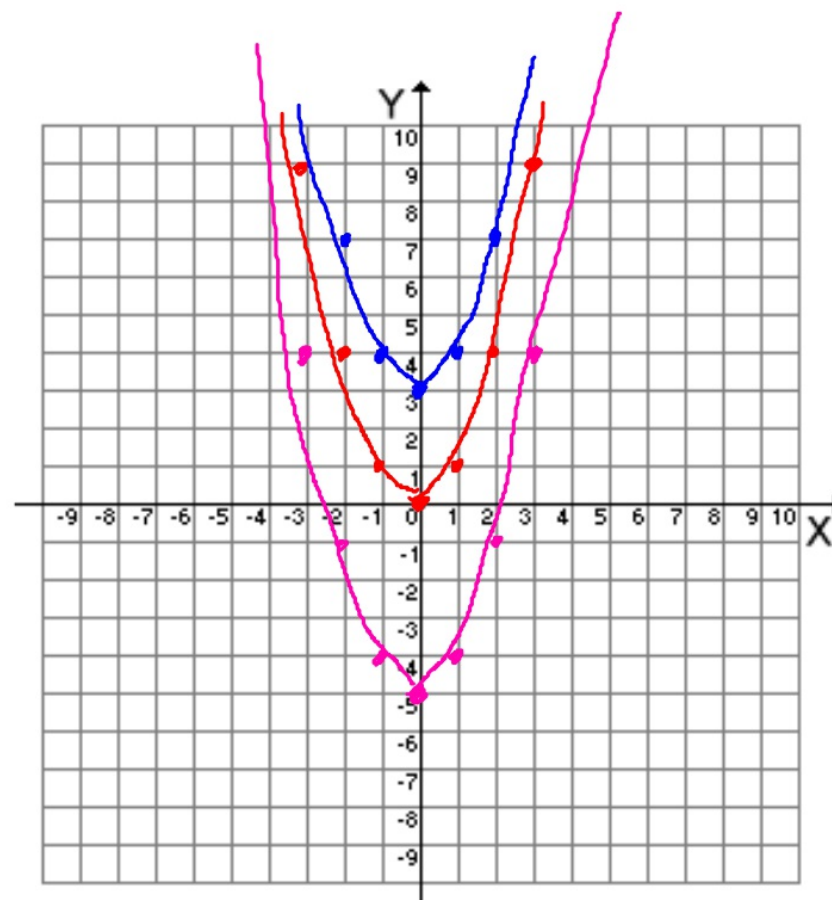
2/27/14

—  $y = x^2$

—  $y = x^2 + 3$  up 3

—  $y = x^2 - 5$  down 5

$y = x^2 + v$



IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.

## 4.4 Shifting Functions

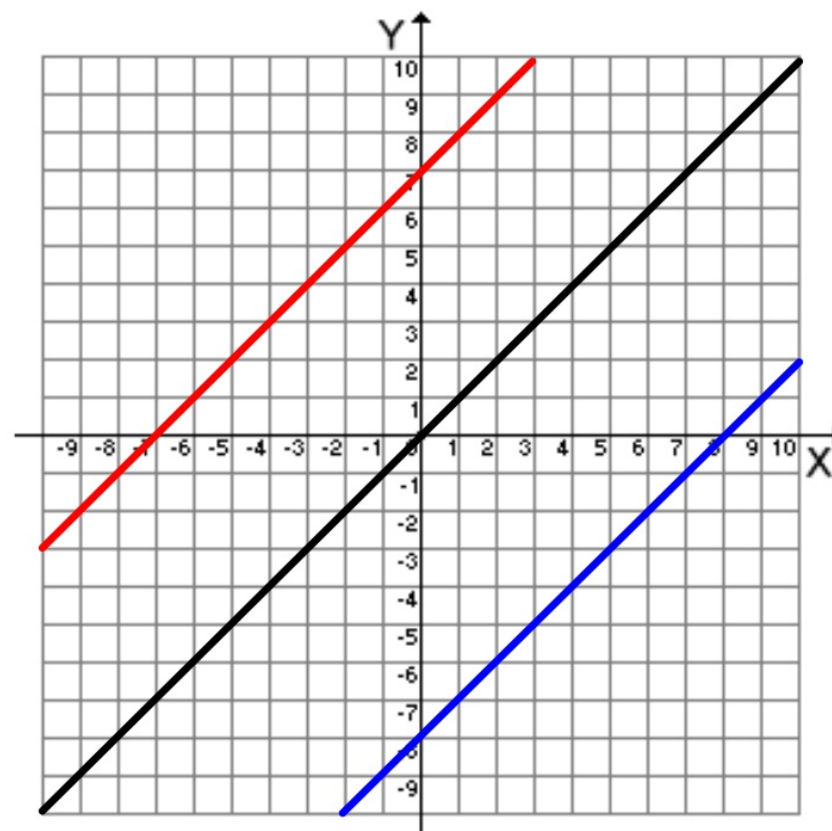
2/27/14

### Vertical Shift

$$y = x$$

$$y = x + 7$$

$$y = x - 8$$



IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.

## 4.4 Shifting Functions

2/27/14

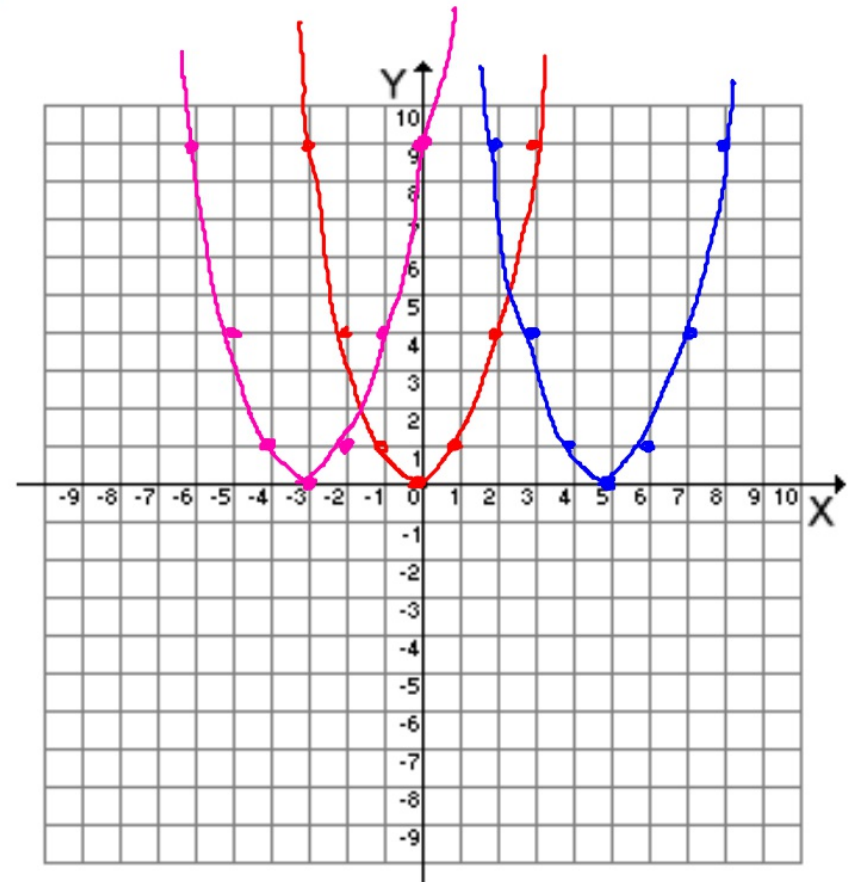
$$(x - -3) = (x + 3)$$

$$y = x^2$$

—  $y = (x + 3)^2$  left 3

—  $y = (x - 5)^2$  right 5

$$y = (x - h)^2$$



IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.

## 4.4 Shifting Functions

2/27/14

### Horizontal Shift

$$y = x$$

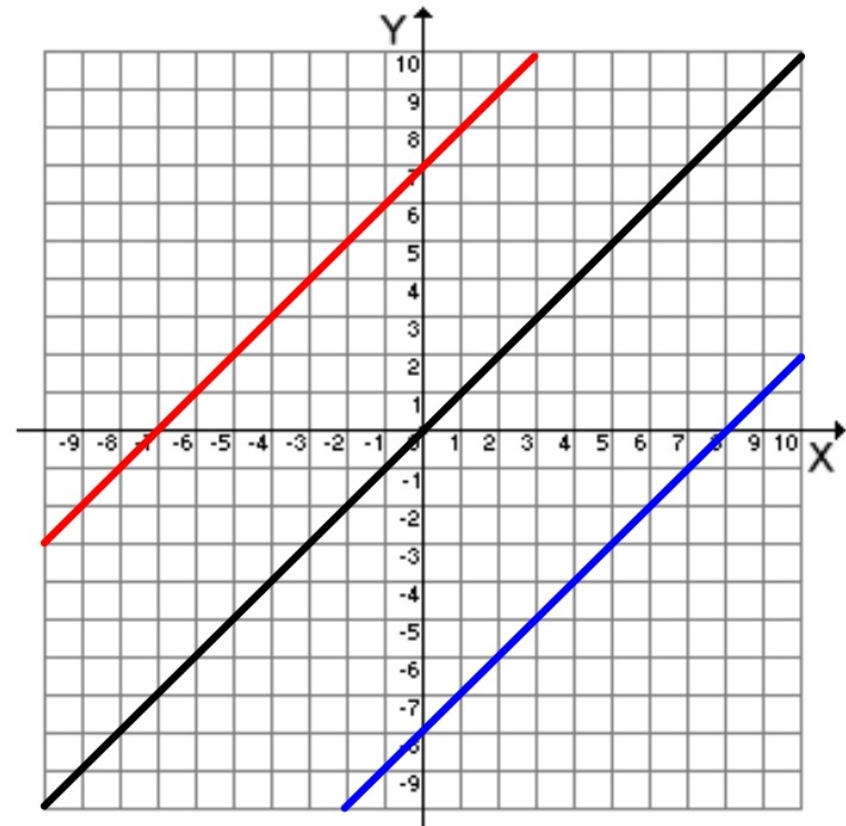
$$y = (x + 7)$$

$$x = x + 7$$

$$y = (x - 8)$$

$$x = x - 8$$

Linear functions  
move only vertically  
(up or down)



IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.



## 4.4 Shifting Functions

2/27/14

$$y = |(x + 6)|^2 - 3$$

Left 6, down 3

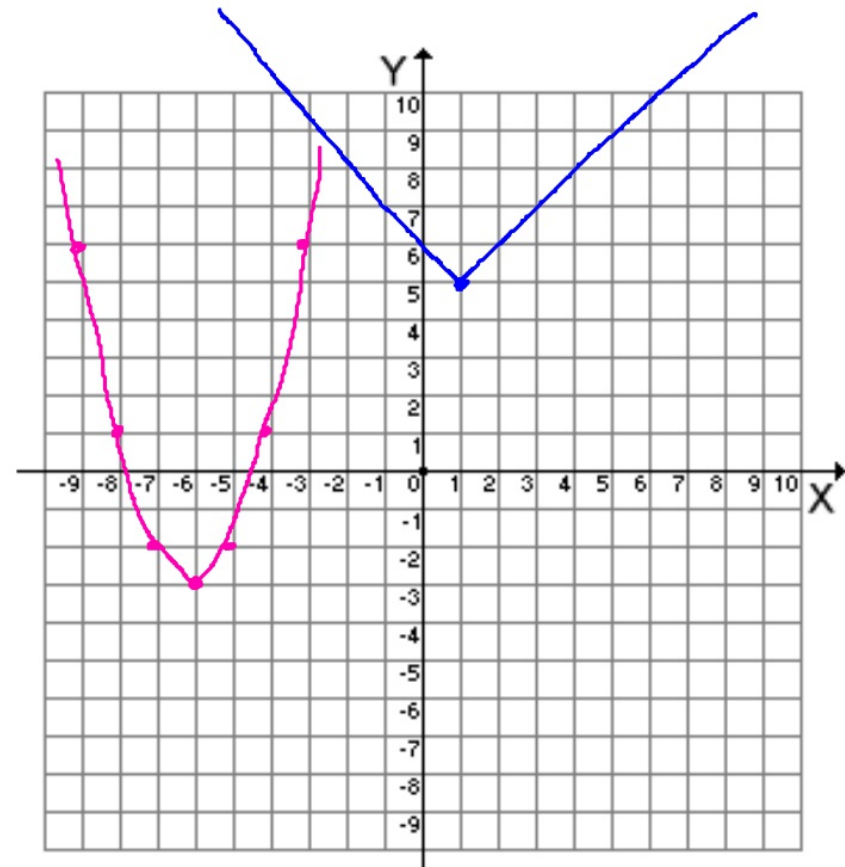
$$y = (x - h)^2 + V$$

$$y = |x - 1| + 5$$

right 1, up 5

$$y = |x - h| + V$$

$$y = \frac{1}{x - h} + V$$



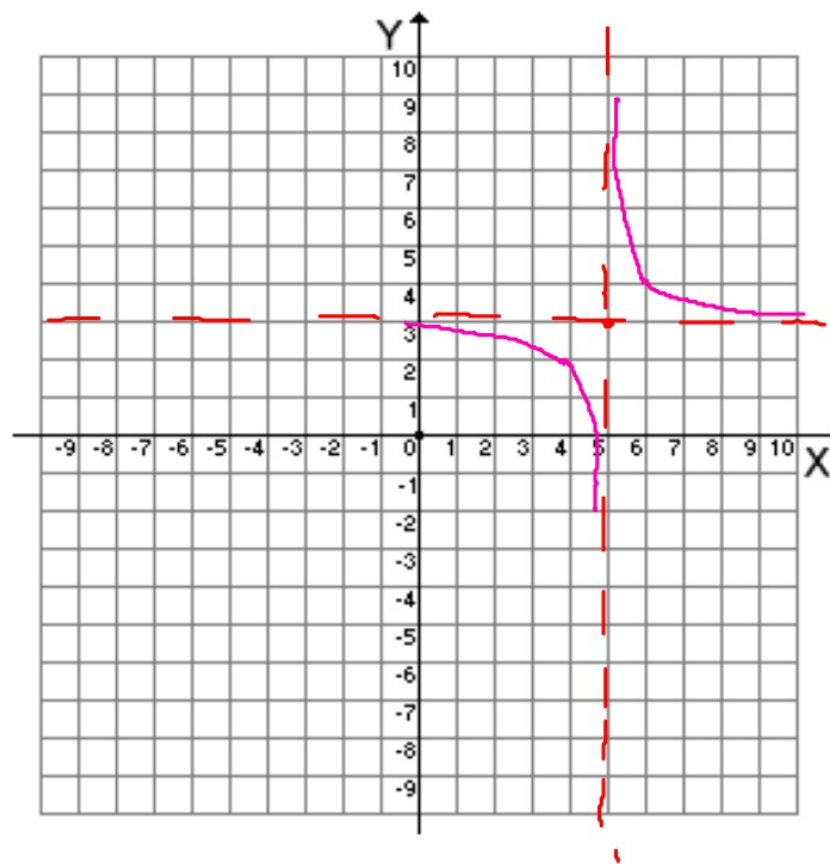
IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.

## 4.4 Shifting Functions

2/27/14

$$y = \frac{1}{x-5} + 3$$

right 5, up 3



IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.

## 4.4 Shifting Functions

2/27/14

Vocabulary 4.4.1 p. 28  
Practice problems 4.4.2

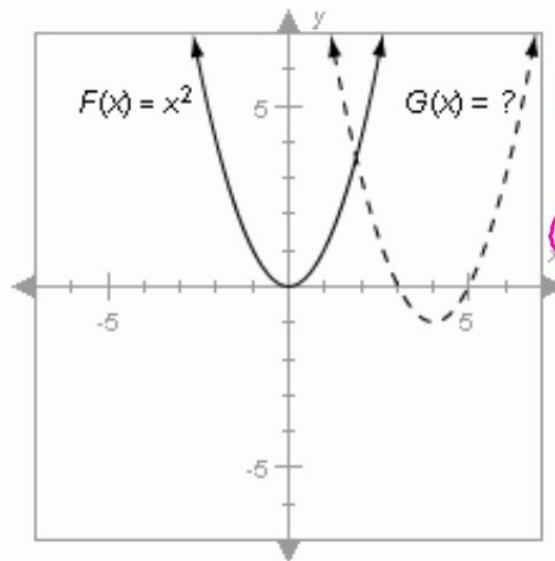
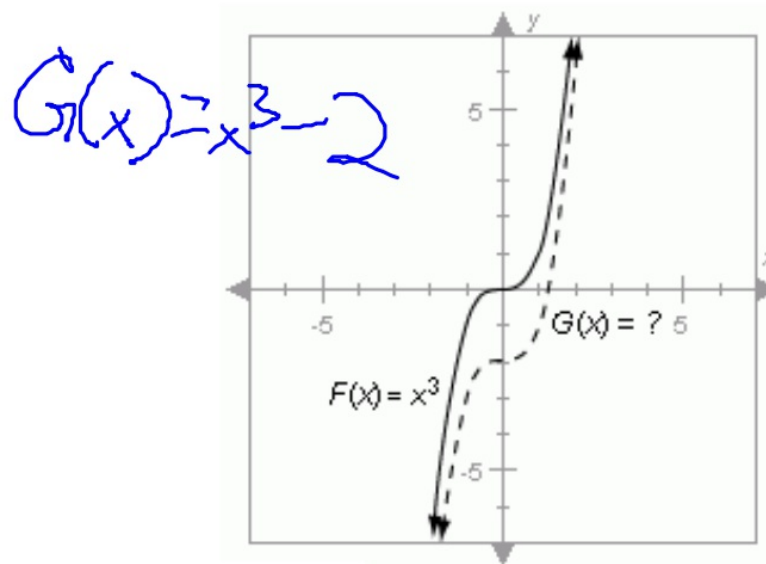
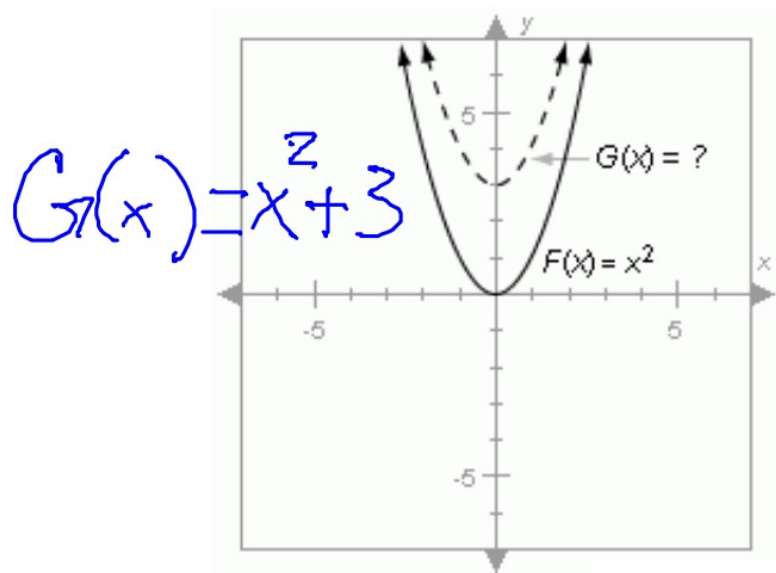
Complete quizzes  
4.4.3, 4.4.4, & 4.4.5

IWBAT identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.

## 4.5 Stretching Functions Vertically

2/28/14

Identify the equation of a function whose graph has been shifted horizontally or vertically from the original graph.



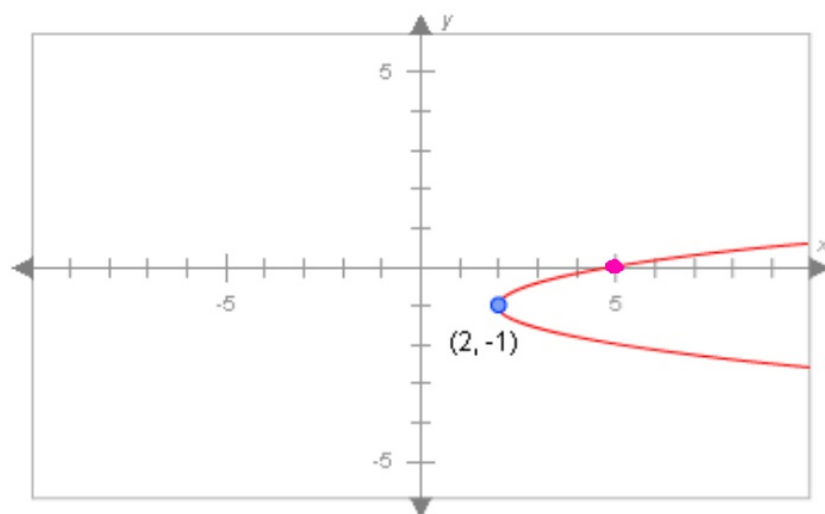
$G(x) = \frac{1}{4}x^2 - 1$   
 $G(x) = (x - \frac{1}{2})^2 - 1$

## 4.5 Stretching Functions Vertically

2/28/14

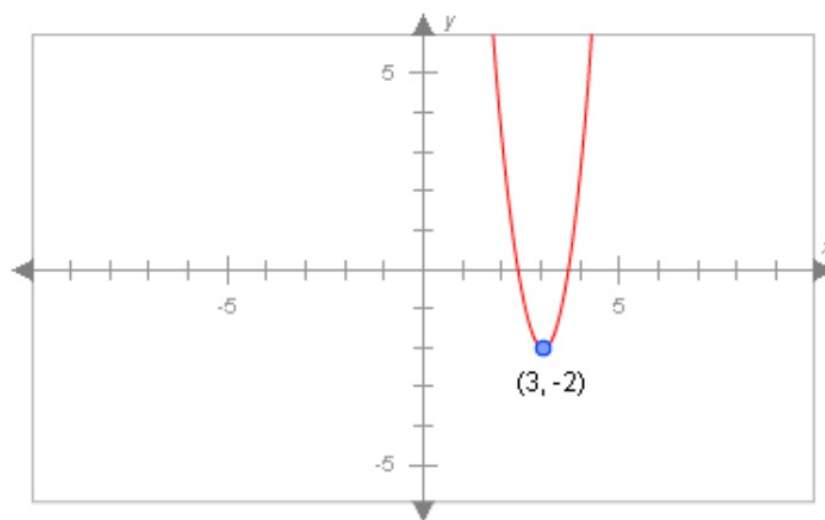
**Identify the equation of a function whose graph has been stretched or compressed from the original graph.**

The vertex of this parabola is at (2, -1). When the y-value is 0, the x-value is 5. What is the coefficient of the squared term in the parabola's equation?



$$x = 3(y + 1)^2 + 2$$

The vertex of this parabola is at (3, -2). When the x-value is 4, the y-value is 3. What is the coefficient of the squared expression in the parabola's equation?



$$y = 5(x - 3)^2 - 2$$



## 4.5 Stretching Functions Vertically

2/28/14

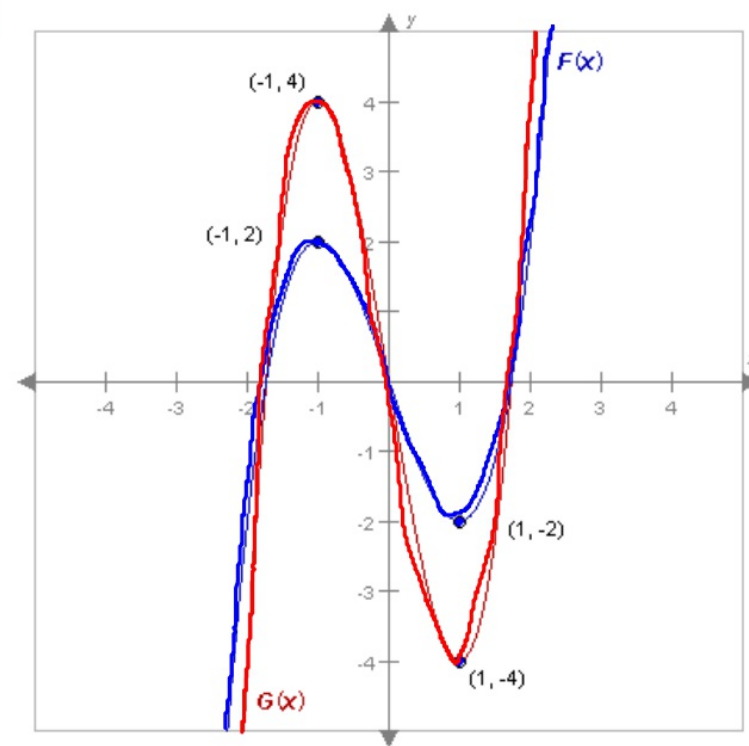
**Identify the equation of a function whose graph has been stretched or compressed from the original graph.**

Compare  $G(x)$  to  $F(x)$ . What has happened to the graph?

Stretched  
 $(-1, 2)$   $(-1, 4)$   $\frac{4}{2} = 2$

$(1, -2)$   $(1, -4)$   $\frac{-4}{-2} = 2$

Stretched vertically  
by a factor of 2



## 4.5 Stretching Functions Vertically

2/28/14

**Identify the equation of a function whose graph has been stretched or compressed from the original graph.**

Compare  $F(x)$  to  $G(x)$ . What has happened to the graph?

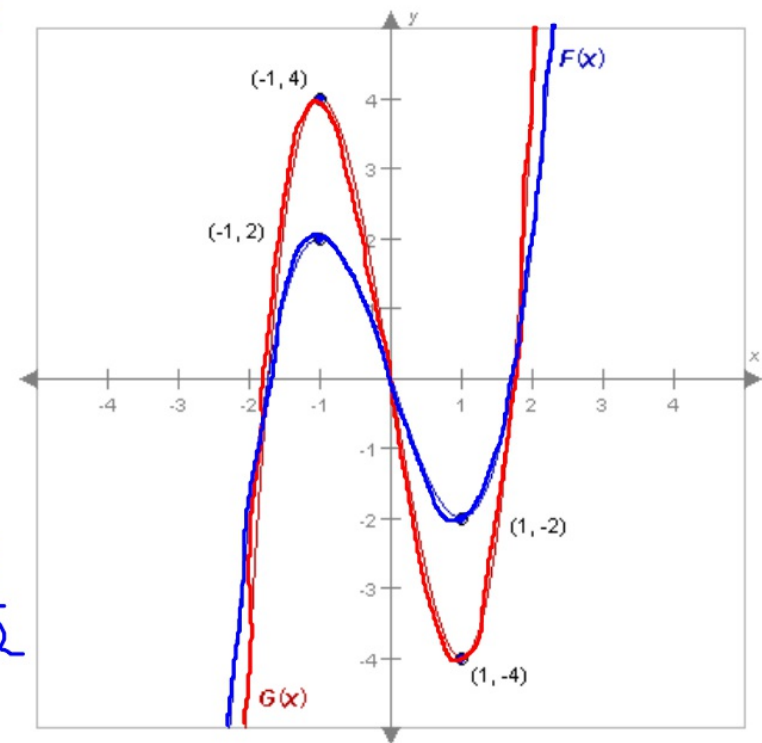
$$(-1, 4) \quad (-1, 2) \quad \frac{2}{4} = \frac{1}{2}$$

$$(1, -4) \quad (1, -2) \quad \frac{-2}{-4} = \frac{1}{2}$$

Shrunk/compressed  
Vertically by a factor of  $\frac{1}{2}$

factor  $> 1$  stretched

factor  $0 < a < 1$  compressed



## 4.5 Stretching Functions Vertically

2/28/14

IWBAT identify the graph of a function after the equation is multiplied by a positive or negative number and determine the equation of a function that results from a stretch or compression, as well as a vertical or horizontal shift. I will capture my thinking using the math note catcher including teacher and student-team modeled example problems on the Promethean board. I will demonstrate my understanding on my exit ticket.

## 4.5 Stretching Functions Vertically

2/28/14

Flip vertically reflected across the x-axis

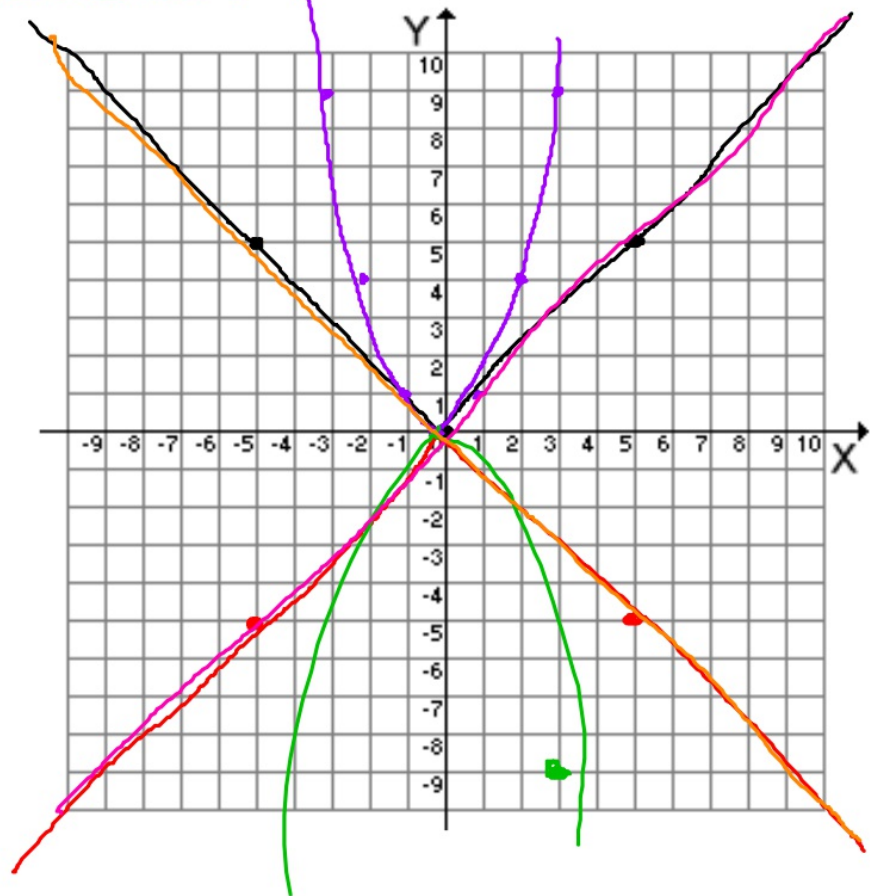
$$f(x) = |x|$$
$$y = |x|$$
$$\frac{-y}{-1} = \frac{|x|}{-1}$$

$$y = -|x|$$

$$y = -x^2$$

$$y = x$$

$$y = -x$$



IWBAT identify the graph of a function after the equation is multiplied by a positive or negative number and determine the equation of a function that results from a stretch or compression, as well as a vertical or horizontal shift.



## 4.5 Stretching Functions Vertically

2/28/14

Flip horizontally

$$f(x) = (x - 2)^3$$

$$y = (x - 2)^3$$

$$y = (-x - 2)^3$$

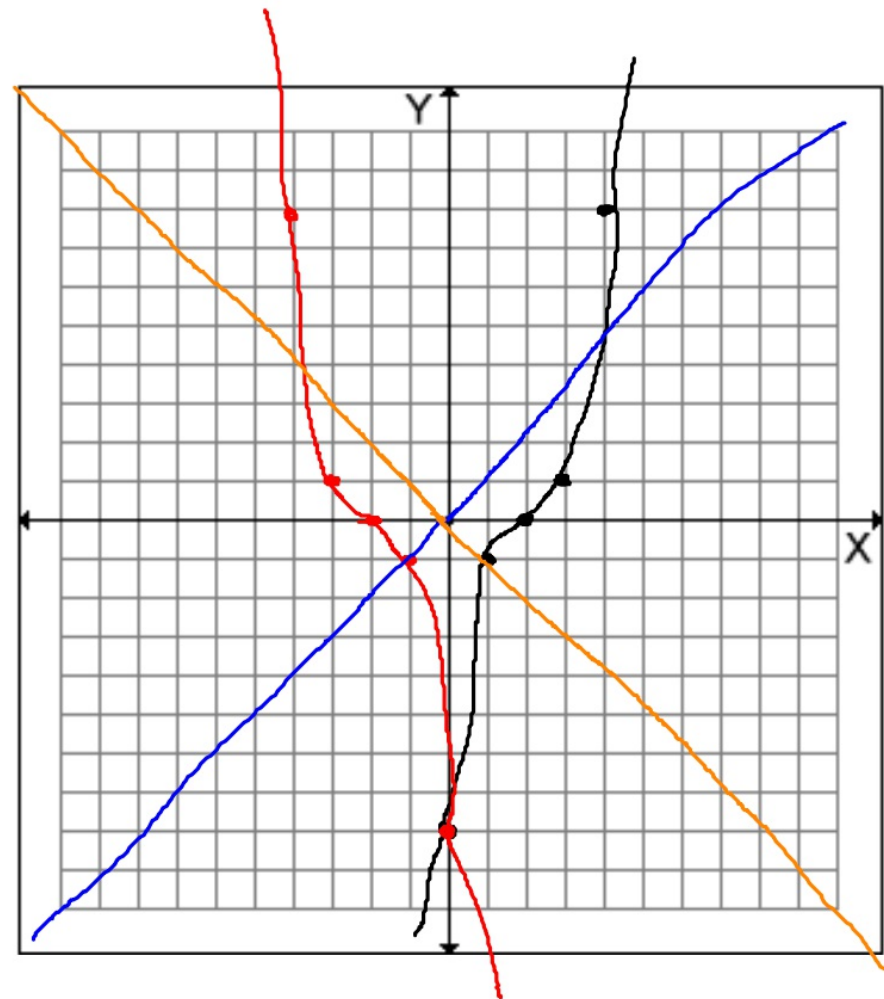
$$y = (-(-1) - 2)^3$$

$$y = (-(-3) - 2)^3$$

$$y = (-(-4) - 2)^3$$

$$y = x$$

$$y = (-x) = -x$$



IWBAT identify the graph of a function after the equation is multiplied by a positive or negative number and determine the equation of a function that results from a stretch or compression, as well as a vertical or horizontal shift.



## 4.5 Stretching Functions Vertically

2/28/14

Compare  $F(x)$  to  $G(x)$ . What has happened to the graph? What is the new equation?

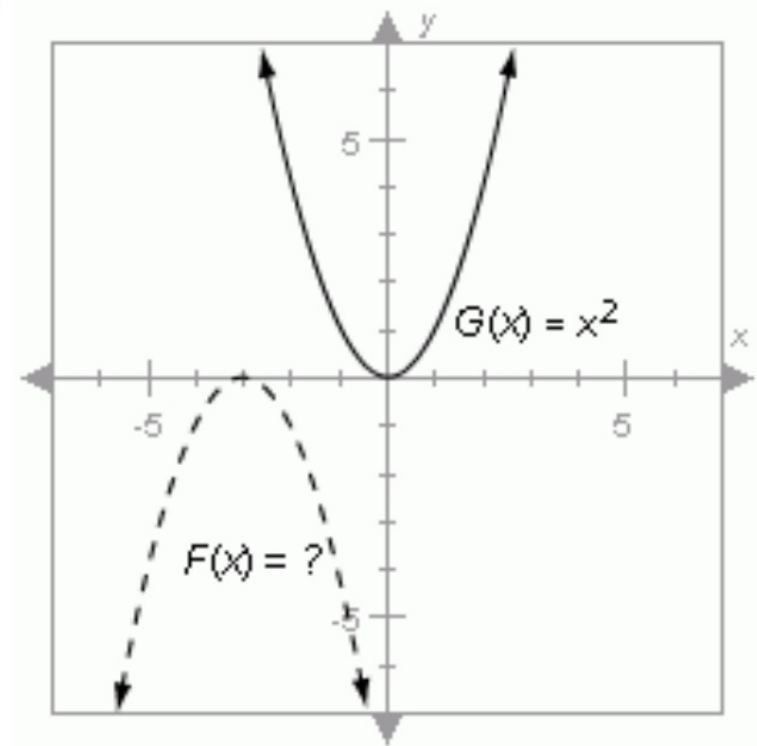
reflected vertically

Shifted left

$$y = x^2$$

$$y = -x^2 \text{ flip}$$

$$y = -(x+3)^2 \text{ shifted left + flipped V.}$$



IWBAT identify the graph of a function after the equation is multiplied by a positive or negative number and determine the equation of a function that results from a stretch or compression, as well as a vertical or horizontal shift.

## 4.5 Stretching Functions Vertically

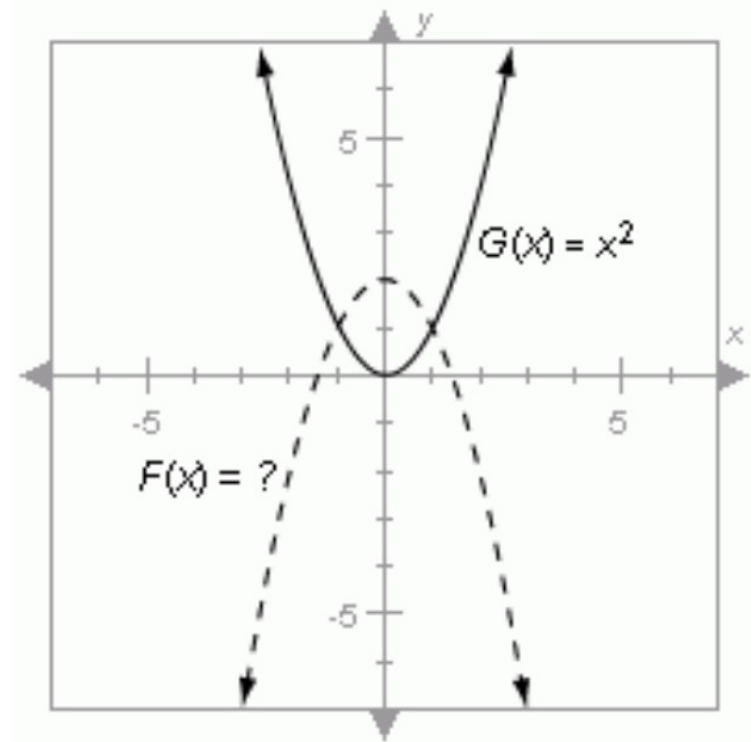
2/28/14

Compare  $F(x)$  to  $G(x)$ . What has happened to the graph? What is the new equation?

reflected U.

shifted up

$$y = -x^2 + 2$$



IWBAT identify the graph of a function after the equation is multiplied by a positive or negative number and determine the equation of a function that results from a stretch or compression, as well as a vertical or horizontal shift.

## 4.5 Stretching Functions Vertically

2/28/14

Summarize our learning.

reflect/flip vertically

reflect/flip horizontally

divide/mult. by  $-1$

replace  $x$  with  $-x$

## 4.5 Stretching Functions Vertically

2/28/14

Vocabulary 4.5.1 p. 18  
Practice problems 4.5.2

Complete quiz 4.5.3

IWBAT identify the graph of a function after the equation is multiplied by a positive or negative number and determine the equation of a function that results from a stretch or compression, as well as a vertical or horizontal shift.

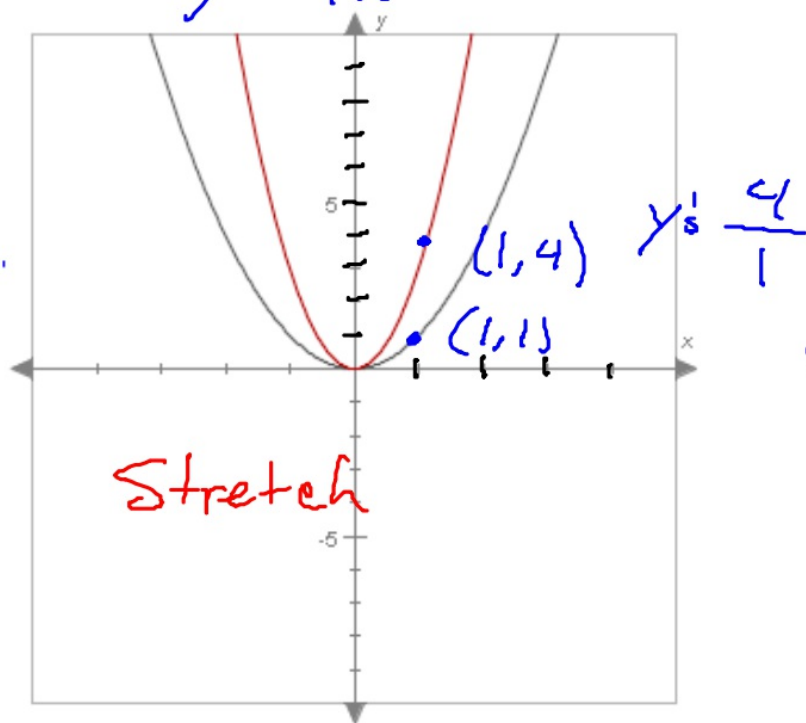
## 4.6 Transformation of Parent Functions

3/03/14

Identify the equation of a function whose graph has been stretched or compressed from the original graph.

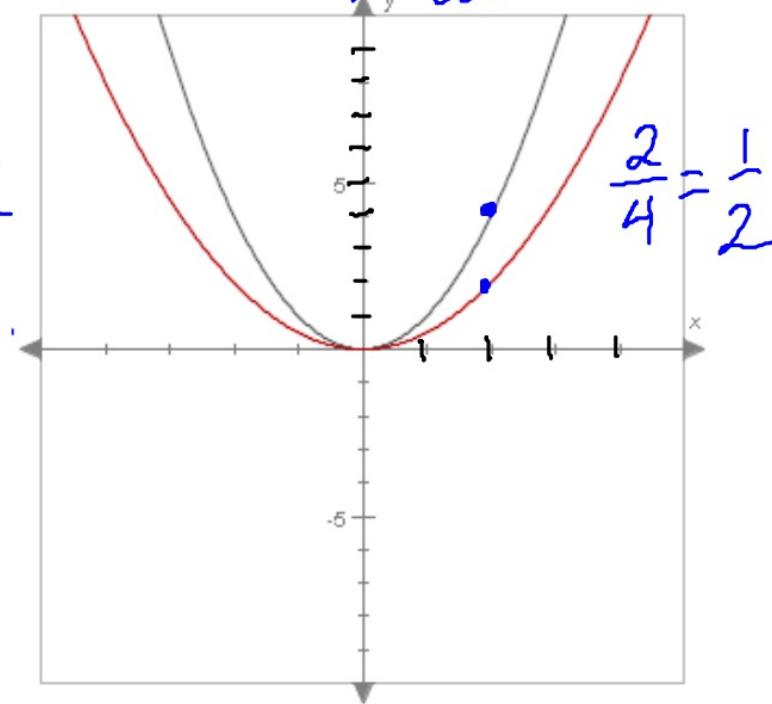
$$y = x^2$$

$$y = 4x^2$$



$$y_s = \frac{4}{1}$$

$$y = \frac{1}{2}x^2$$



$$\frac{2}{4} = \frac{1}{2}$$

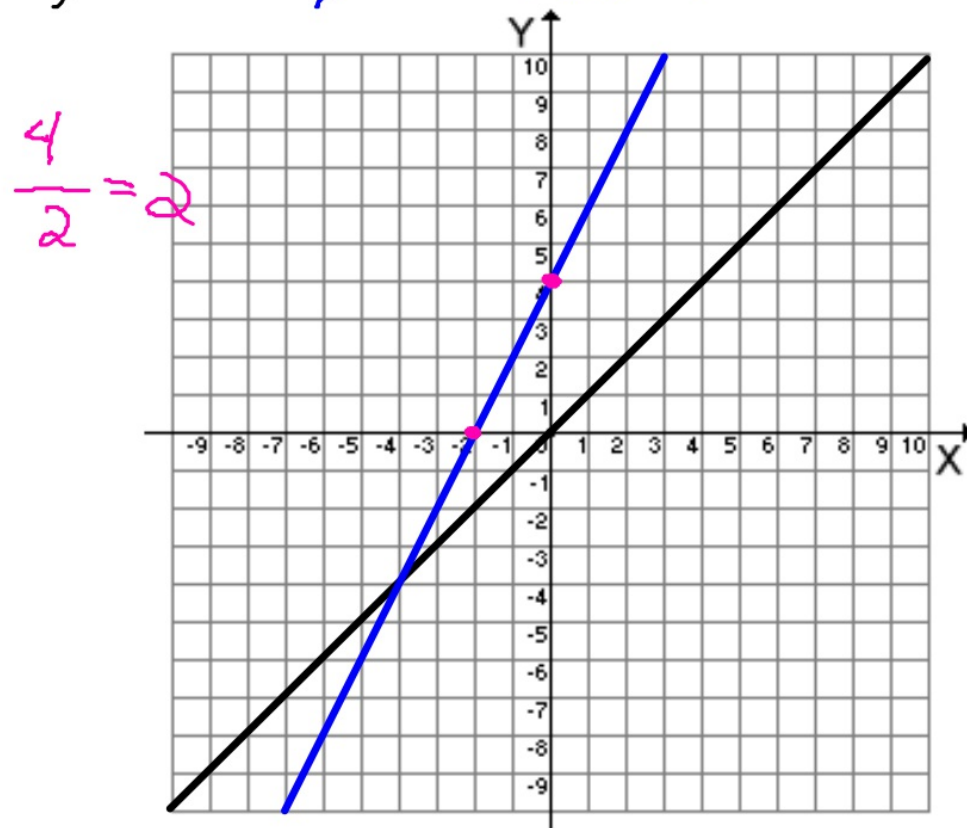


## 4.6 Transformation of Parent Functions

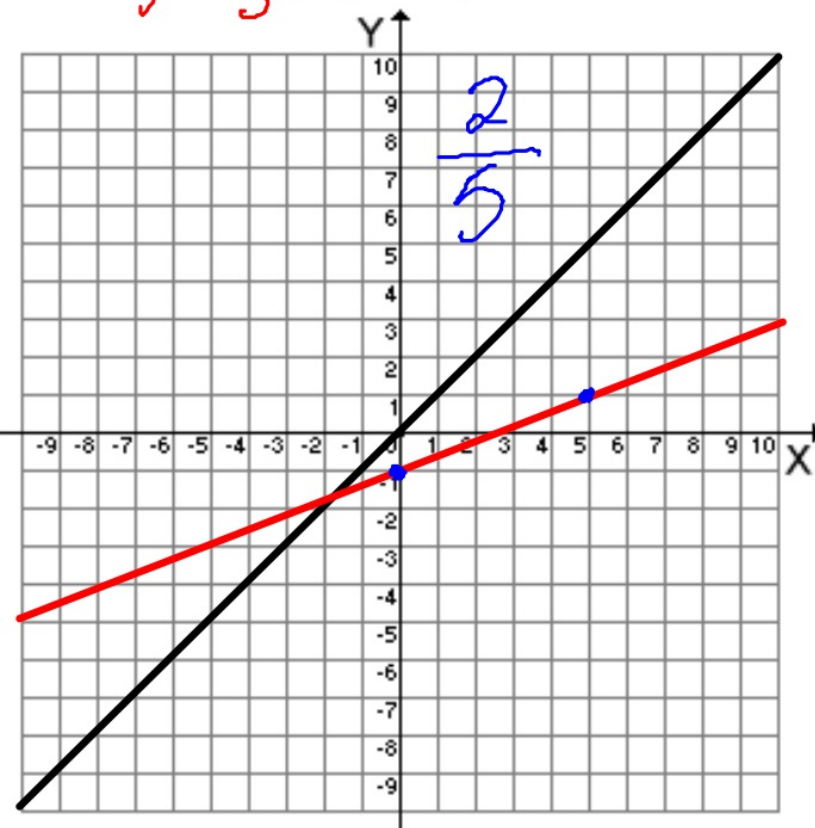
3/03/14

Identify the equation for a parent function whose graph has been shifted horizontally or vertically.

$$y = x \quad y = 2x + 4$$



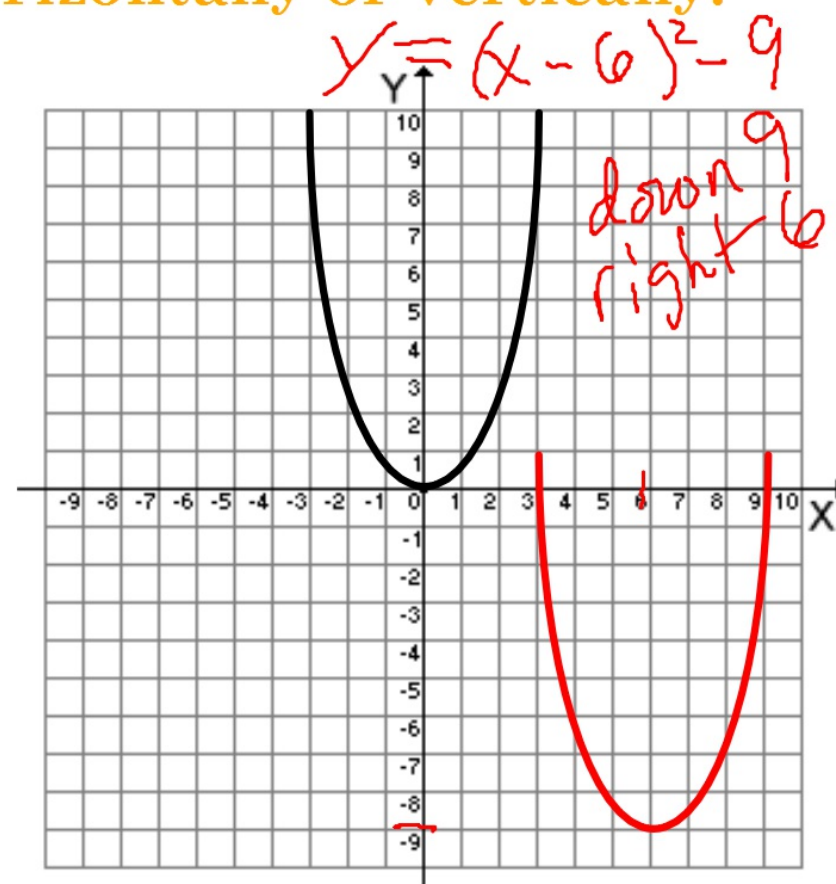
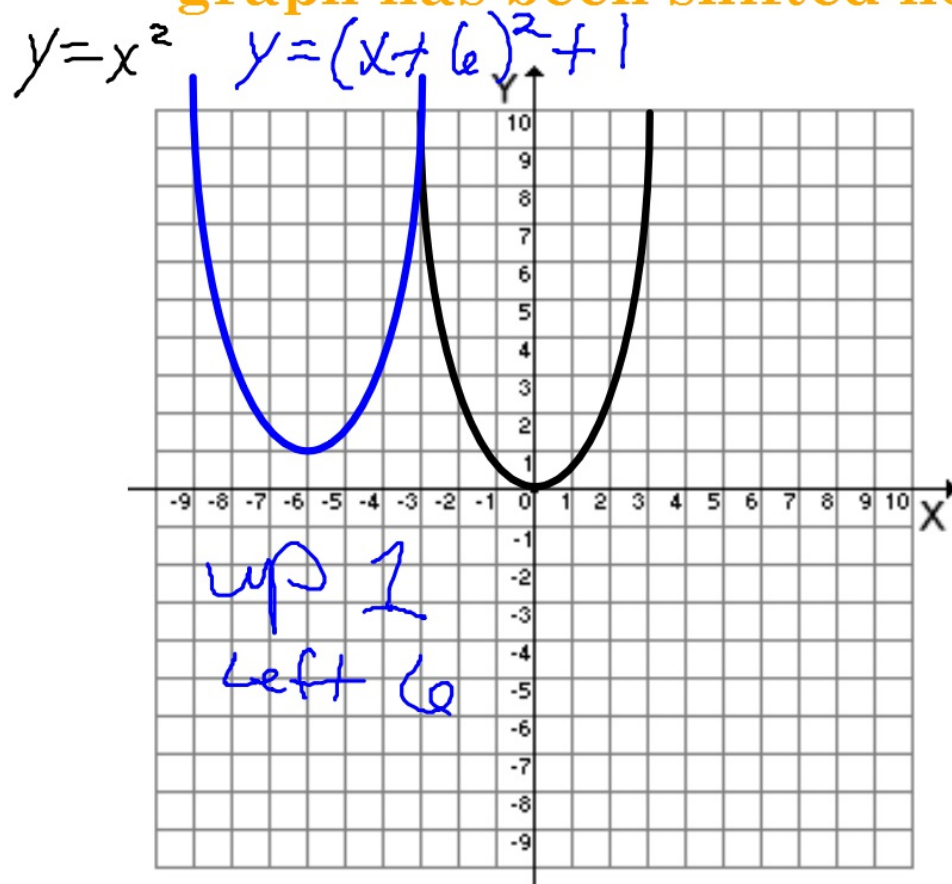
$$y = -\frac{2}{5}x - 1$$



## 4.6 Transformation of Parent Functions

3/03/14

Identify the equation for a parent function whose graph has been shifted horizontally or vertically.



IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips. I will capture my thinking using the math note catcher including teacher and student-team modeled example problems on the Promethean board. I will demonstrate my understanding on my exit ticket.

## 4.6 Transformation of Parent Functions

3/03/14

absolute value family

$$y = |x|$$

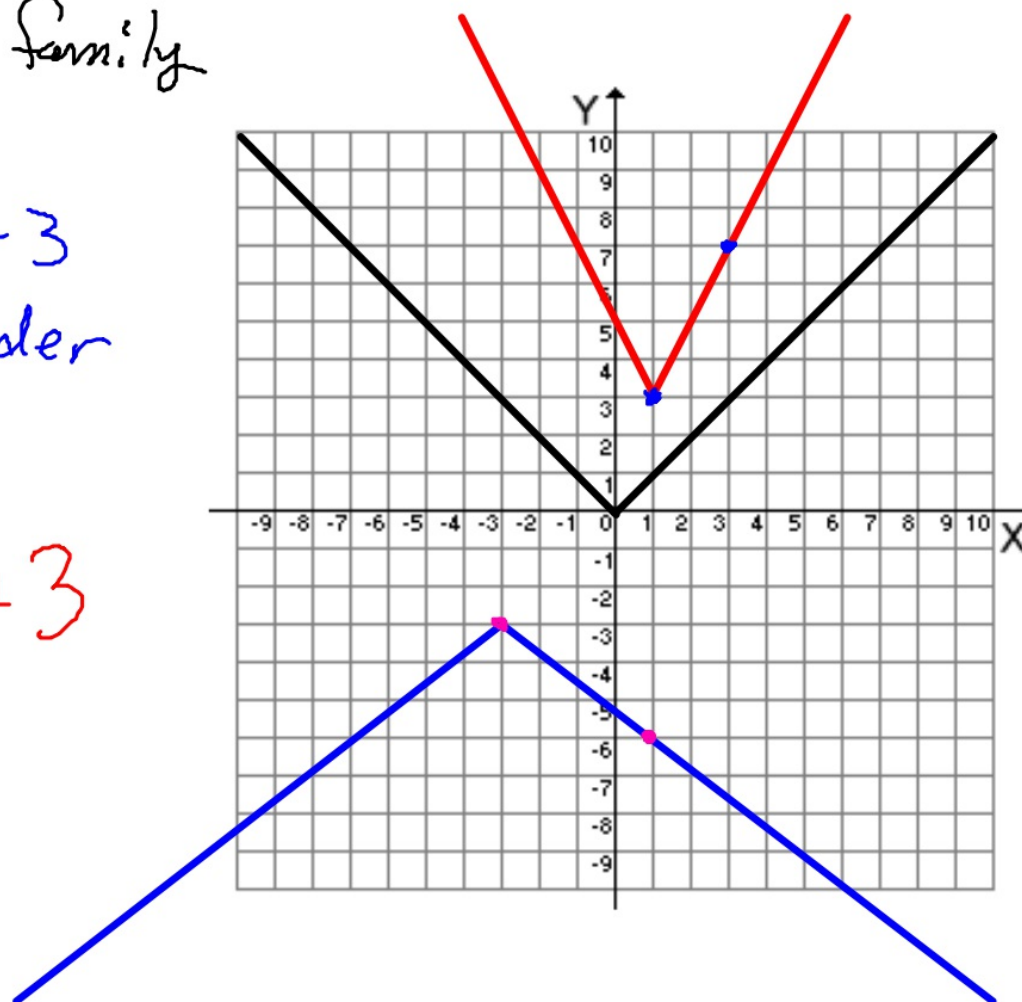
$$y = -\frac{3}{4}|x+3| - 3$$

down, left, wider

$$\frac{\text{rise}}{\text{run}} = \frac{-3}{4}$$

$$y = 2|x-1| + 3$$

$$\frac{4}{2}$$



IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips.



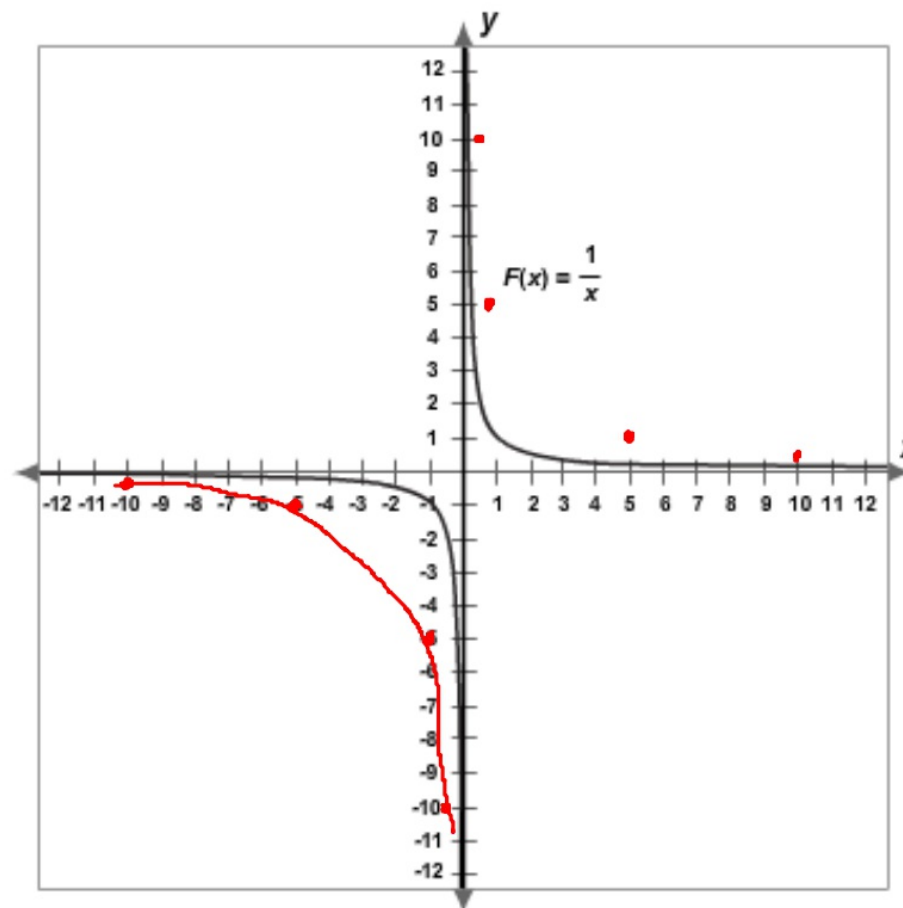
## 4.6 Transformation of Parent Functions

3/03/14

$y = \frac{1}{x}$   
reciprocal family

Stretch by a factor  
of 5

$$y = 5\left(\frac{1}{x}\right) = \frac{5}{x}$$



IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips.



## 4.6 Transformation of Parent Functions

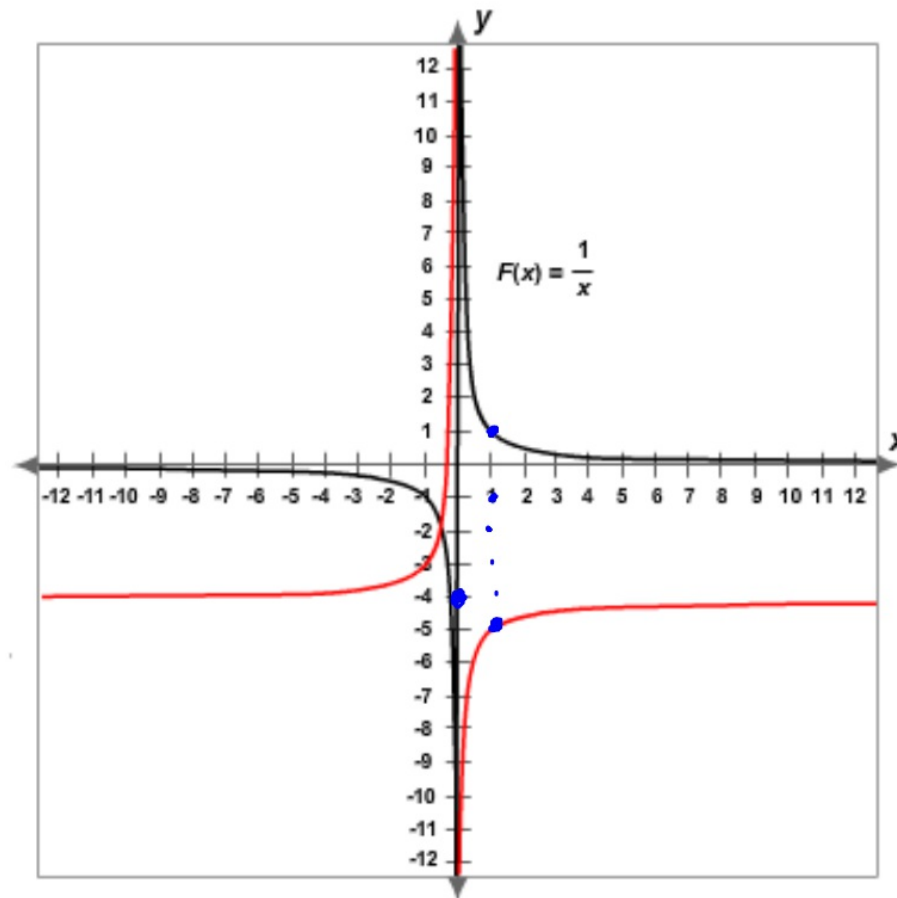
3/03/14

$$y = -1\left(\frac{1}{x}\right) - 4$$

$$h=0 \quad v=-4$$

$$\text{Stretch} = 0$$

$$y = -\frac{1}{x} - 4$$



IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips.

## 4.6 Transformation of Parent Functions

3/03/14

What was done to the reciprocal parent function  $F(x) = \frac{1}{x}$  to

get the function  $G(x) = \frac{4}{(x+1)} - 2$ ?

Stretch by a factor of 4  
down 2  
left 1

IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips.

## 4.6 Transformation of Parent Functions

3/03/14

If you do the following to the linear parent function  $F(x) = x$ , what is the equation of the new function?

- Vertically compress by multiplying by  $\frac{1}{2}$ .
- Flip over the x-axis.
- Shift 4 units to the right.

$$y = -\frac{1}{2}x - 4$$

IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips.

## 4.6 Transformation of Parent Functions

3/03/14

Vocabulary 4.6.1 p. 23  
Practice problems 4.6.2

Complete quiz 4.6.3

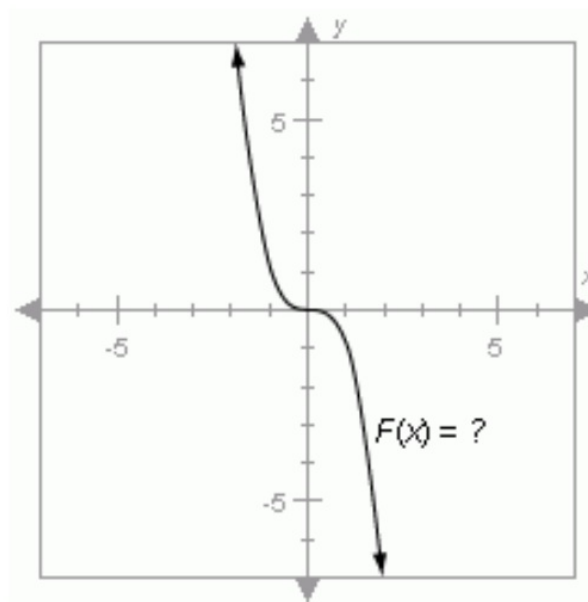
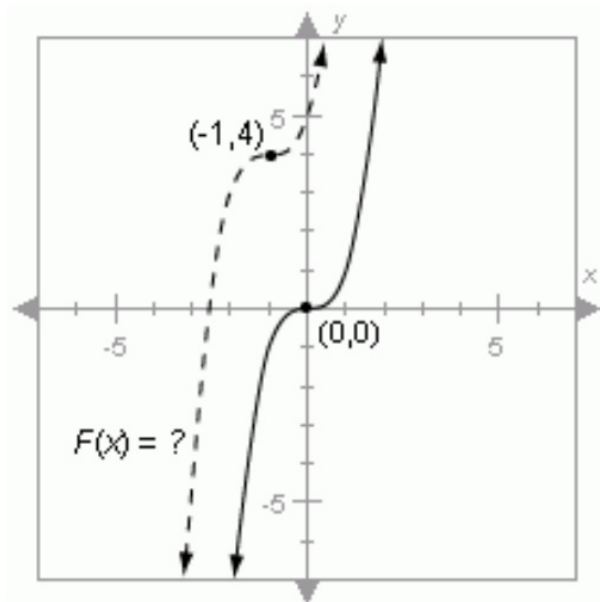
IWBAT identify the equation for a parent function whose graph has been stretched or compressed, identify the equation for a parent function whose graph has been flipped, and identify the equation for a parent function whose graph has been transformed by a combination of shifts, stretches, or flips.

## 4.7 Undoing Functions & Moving Them Around - Wrap Up

3/04/14

Identify the equation for a parent function whose graph has been shifted horizontally or vertically and/or flipped/reflected.

The graph of  $F(x)$ , shown below, has the same shape as the graph of  $G(x) = x^3$  but is flipped over the  $x$ -axis. Write the equation for  $F(x)$ .



If we combined both the movement and the reflection, what would be the resulting equation?